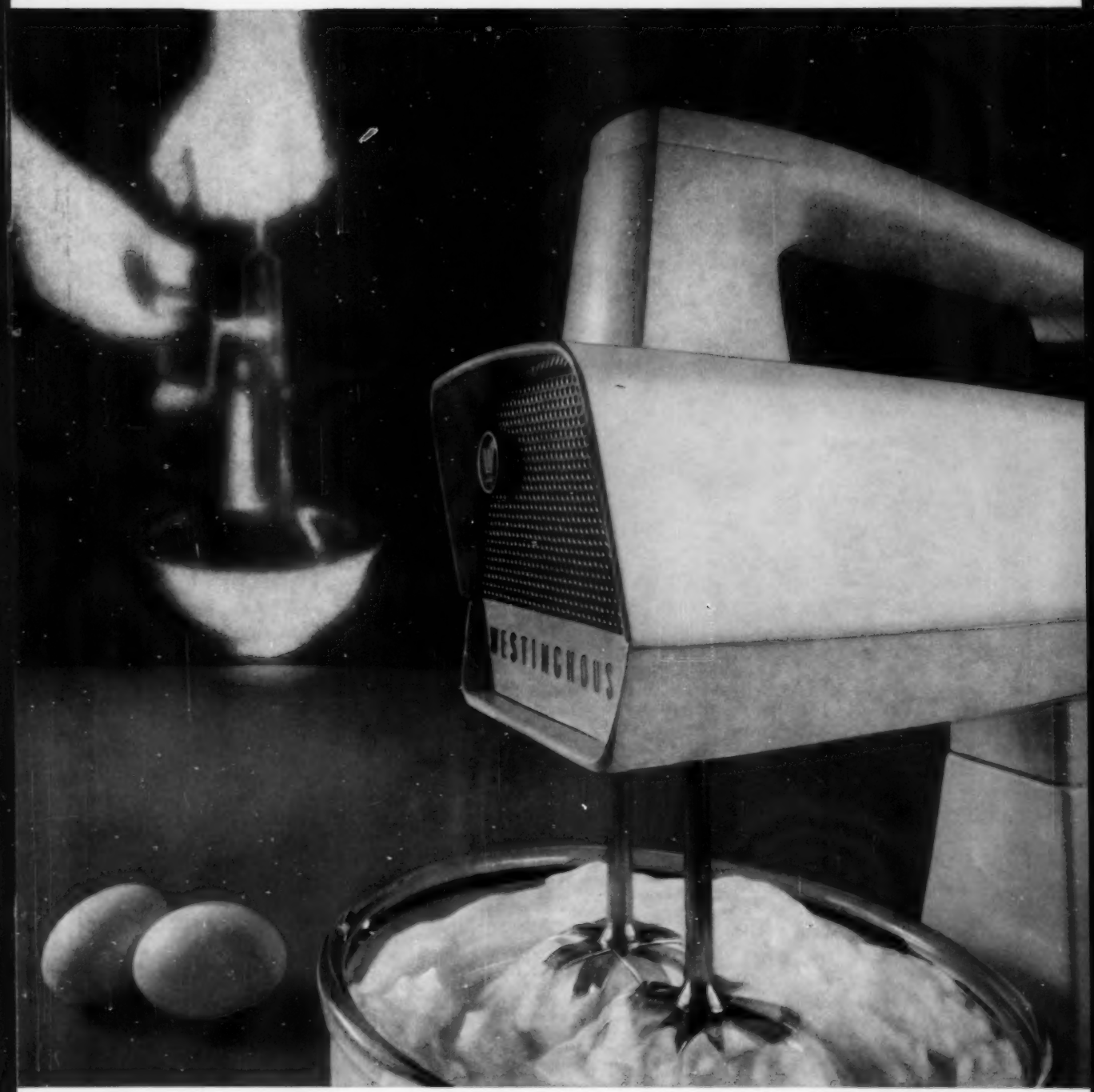
MODERN PLASTICS

MARCH 1960



PHOTOGRAPHED FOR MODERN PLASTICS BY RUDY MULLER

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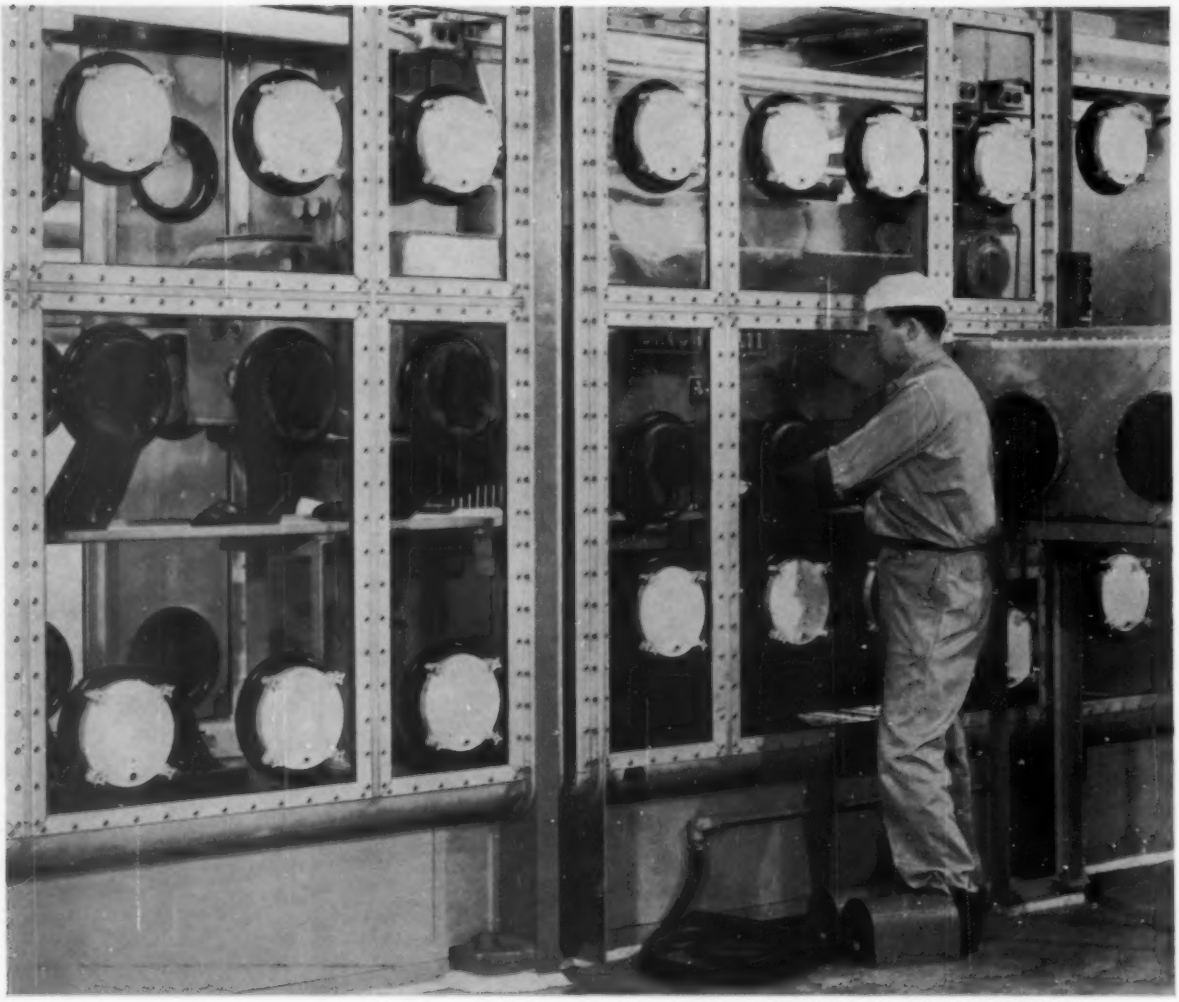
Potentials in polypropylenes *p. 81*

Why and how to tumble thermoplastics *p. 109*

Latest in sandwich structures *p. 92*

Sintering for large parts *p. 86*



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MODERN

THE PLASTISCOPE

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EDITORIAL

Welcome to "Plastec"—a much needed service **266**

Establishment of a plastics evaluation center at Picatinny Arsenal is being greeted with cheers by the plastics industries. Plastics companies now have a golden opportunity to participate in the creation of a central source of plastics data.

GENERAL

Polypropylene—a product evaluation . **81**

With annual production of 30 million lb. of polypropylene expected to grow to 500 million lb. per year by the end of 1963, the question is: where is it all going to go? Judging by an analysis of successful applications to date, appreciable growth can be expected in automotive, housewares, containers, fibers, film, appliances, and several other markets. Physical properties and cost considerations are expected to result in volume usage in many fields not currently served by plastics. Case histories supply the evidence, indicate those areas in which development work still remains to be done.

Large objects with low-cost tooling .. **86**

Introduction of the Engel process to the United States promises to open new markets for polyethylene (high- and low-density) and other thermoplastics. The technique involves fusing of finely powdered resins in sheet steel molds without use of pressure. A step-by-step outline of the process itself, applications, and market potentials are given, together with an economic appraisal of this new method.

Ford goes to PE side shields **88**

By switching from steel to high-density polyethylene for seat side shields of its 1960 cars, Ford Motor Co. was able to reduce part cost by one-third, cut weight per car by about 3 lb., and gain performance characteristics unobtainable with the metal components. Success of application was so phenomenal that other car makers are seriously thinking of following suit.

Sandwich structures **92**

The growing interest in plastics as structural materials has given rise to a number of new developments in the field of sandwich construction. Wide choice of face and core materials now makes it possible to produce structures that are both beautiful and strong. Here is a summary of what is available and the advantages to be gained from various face-core combinations.

Redesign for top of the line **97**

Way back in 1952 American Thermos produced the last of its famous Thermos bottles not to have any plastics part. Since then, the company has been gradually replacing metal, cork, and other materials with plastics. The culmination of this long process of redesign was reached with the recent introduction of its Aristocrat models—all plastics except for the vacuum glass filler. Interestingly, the new plastic bottle represents the highest quality—and most expensive—bottle in their entire line. Here is why they did it and how.

Plastics in the product revolution: electric mixers **100**

When the electric food mixer was introduced in 1930, most of the housings and internal parts were die cast aluminum and zinc. Today electric food mixers, both portable and standup, are almost universally housed in plastics and contain innumerable internal plastics parts. This third of our case histories traces the development.

Everybody needs epoxies **102**

Nos. 19 and 20 in our continuing series on epoxy resin applications deal with the fields of a) casting and b) boats, respectively. Coming: final installment—"Six routes to more epoxy usage."

Systems for casting **102**

Epoxies get sea legs **105**

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PLASTICS*

MARCH 1960
Volume 37 Number 7

• ENGINEERING

Tumbling thermoplastics **109**
Not ordinarily thought of as a thermoplastic finishing technique, tumbling can be used to real advantage in finishing thermoplastic parts. This article tells what can be done and how to go about doing it. *By Joseph Ashmore.*

Thermal and shear degradation in polyethylene extrusion **116**
The authors show that polyethylene can be recycled many times without significant changes in the polymer, provided high temperatures are not employed. *By Hans Schott and W. S. Kaghan.*

How to encapsulate with alkyds **124**
Emphasis on automation and miniaturization in the electronics industries has contributed to the popularity of encapsulation of individual components. Here is a detailed run-down on current molding practices used in encapsulating such parts in alkyds. *By J. J. Moylan and J. T. Long.*

• TECHNICAL

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Olefin and terpene epoxides **137**
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Coming Up . . .

To keep up-to-date on the all-important but ever changing subject of colorants for plastics, our lead feature for April will cover latest data of what colorants to use for what resins; when to dry-color, masterbatch, use colored resin; advances in matching, etc. . . . The Engineering Section will lead off with a new technique of successfully extruding PVC dry blends . . . Other articles of general interest include features on the first plastic gun barrel . . . How the Disabled American Veterans are going to save $\frac{3}{4}$ million per year by going to hot-stamped acetate tags . . . An ingenious "drape" made of modular molded light-stable polystyrene . . . And in the works: resin alloys—what they are, what they can do . . . Some eye-catching developments in office equipment, involving some drastic switches from metal. The plastic story behind the U. S. Post Office's introduction of automatic mail sorters . . . A urea light diffuser developed to meet latest code specifications.

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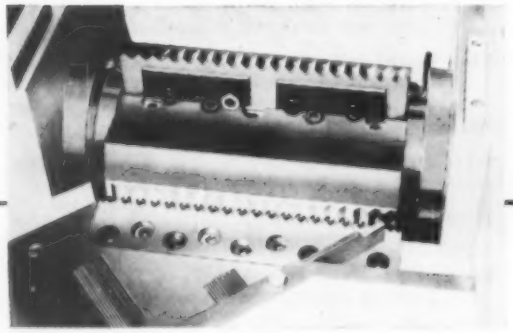
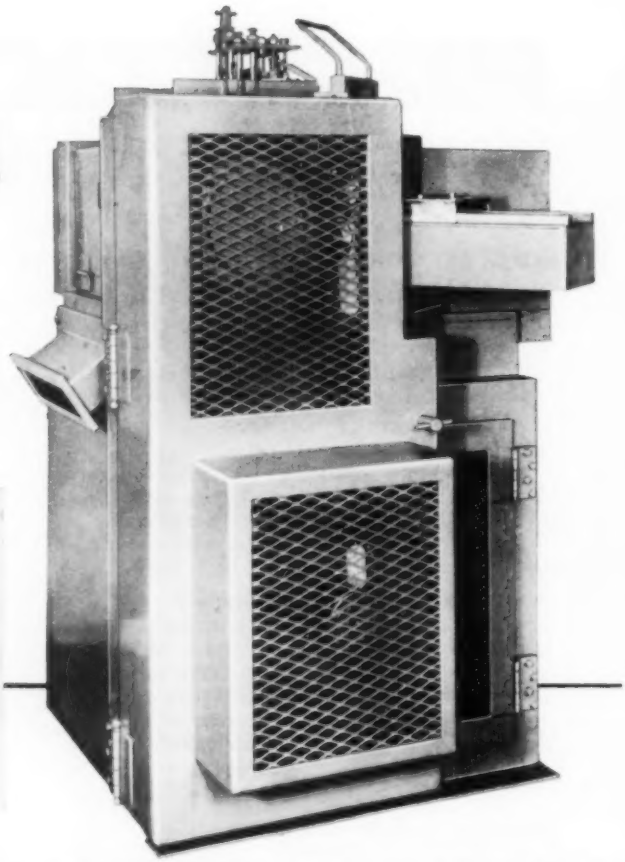
"Stair-Step" DICING MACHINE





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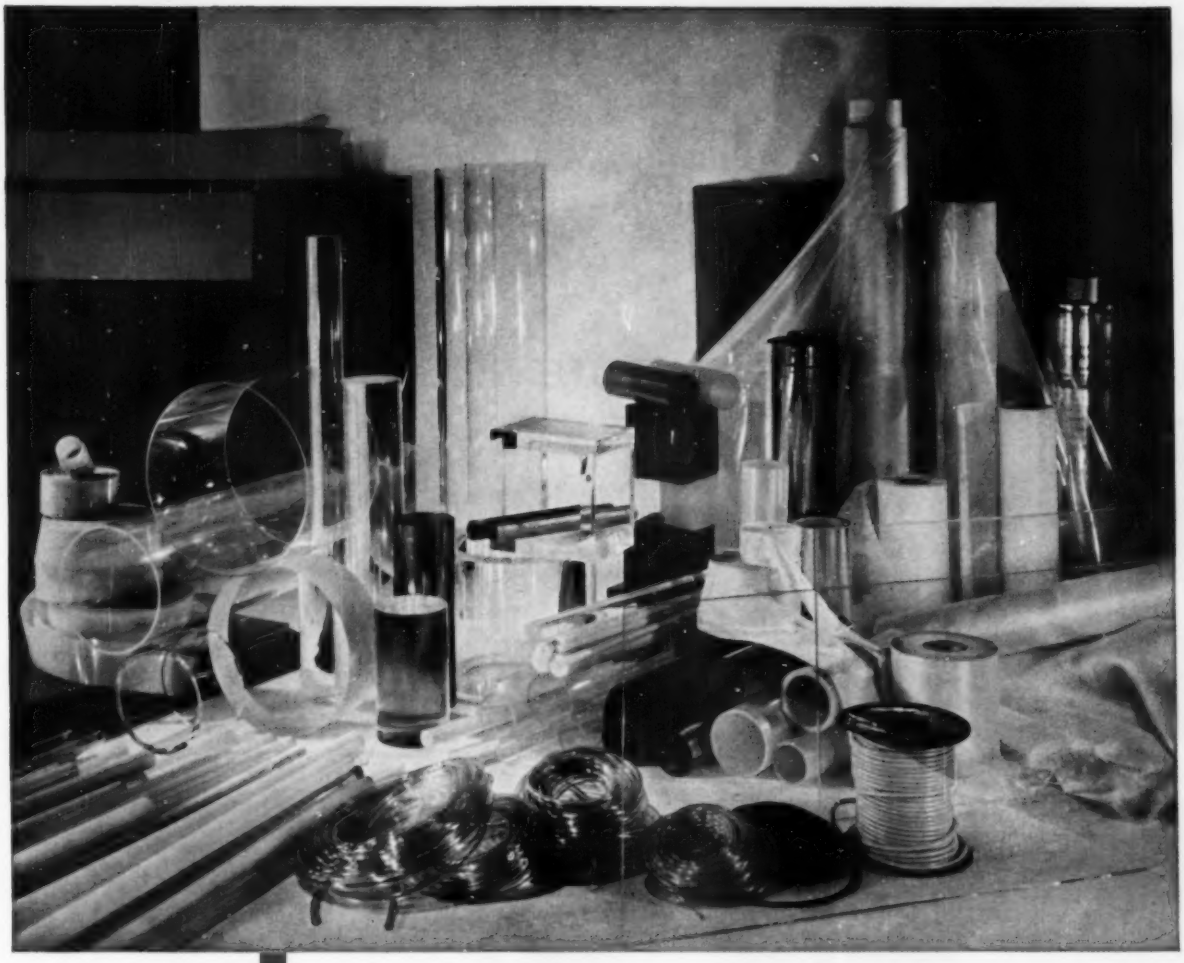

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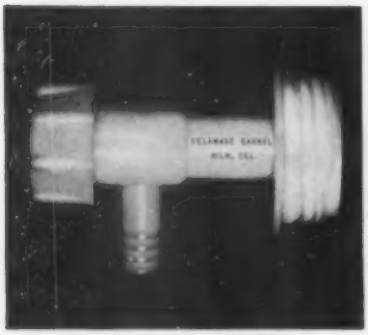

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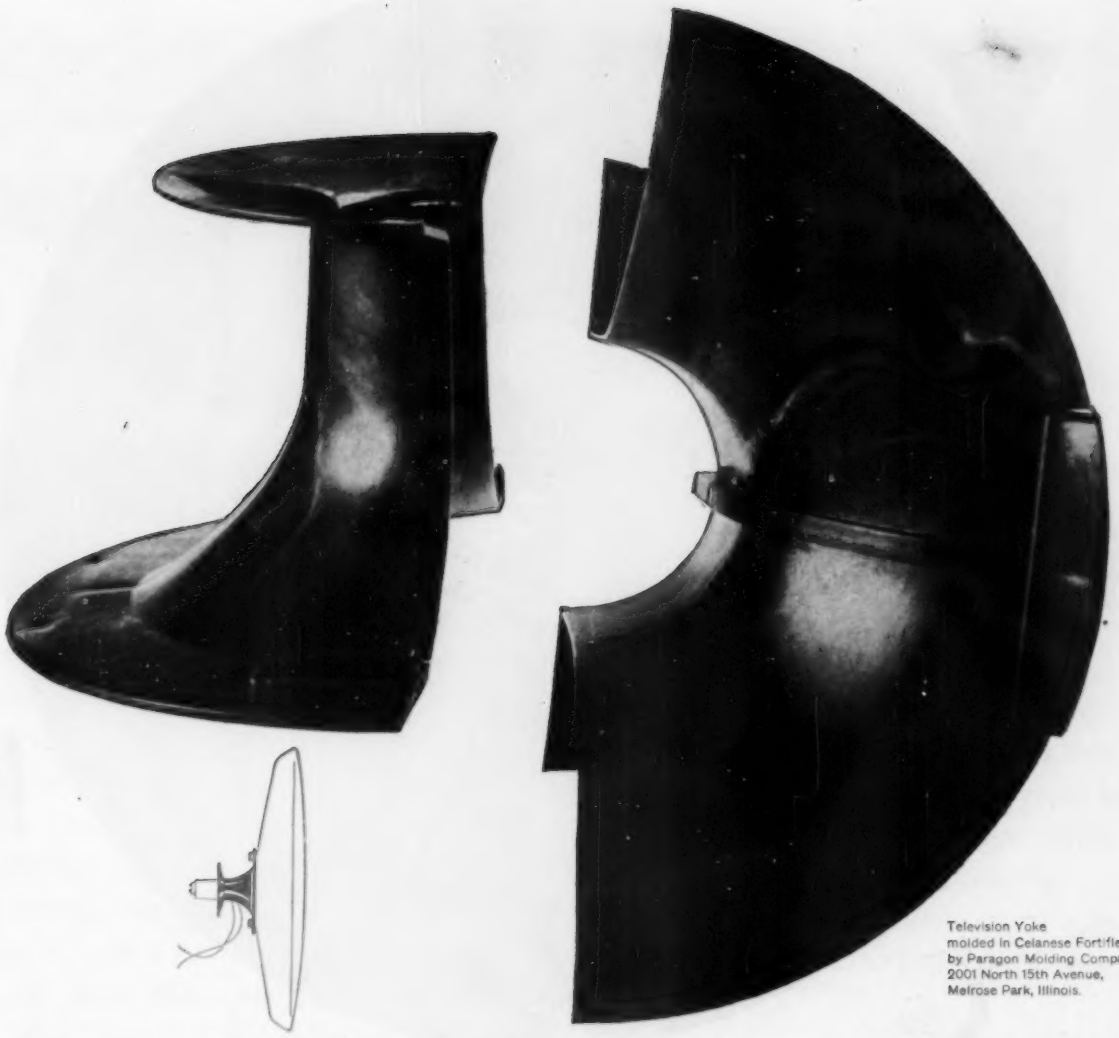

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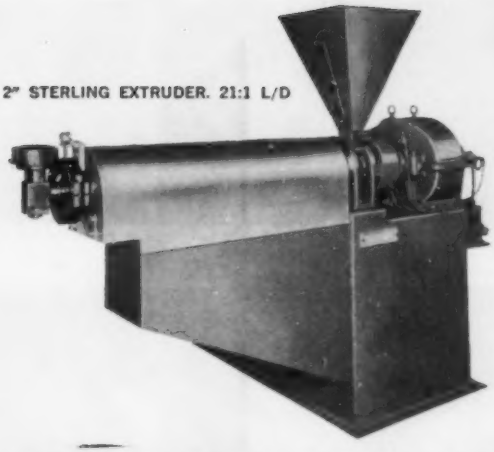

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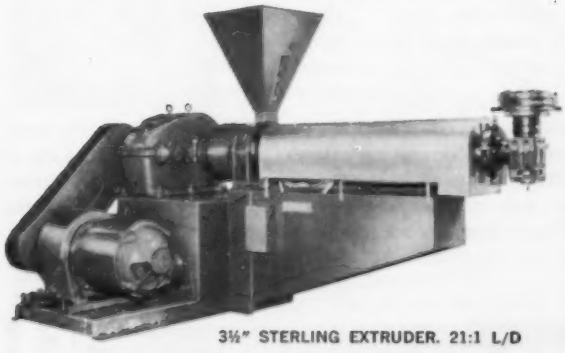

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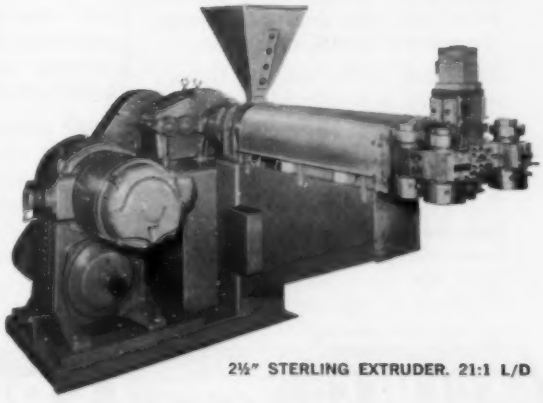

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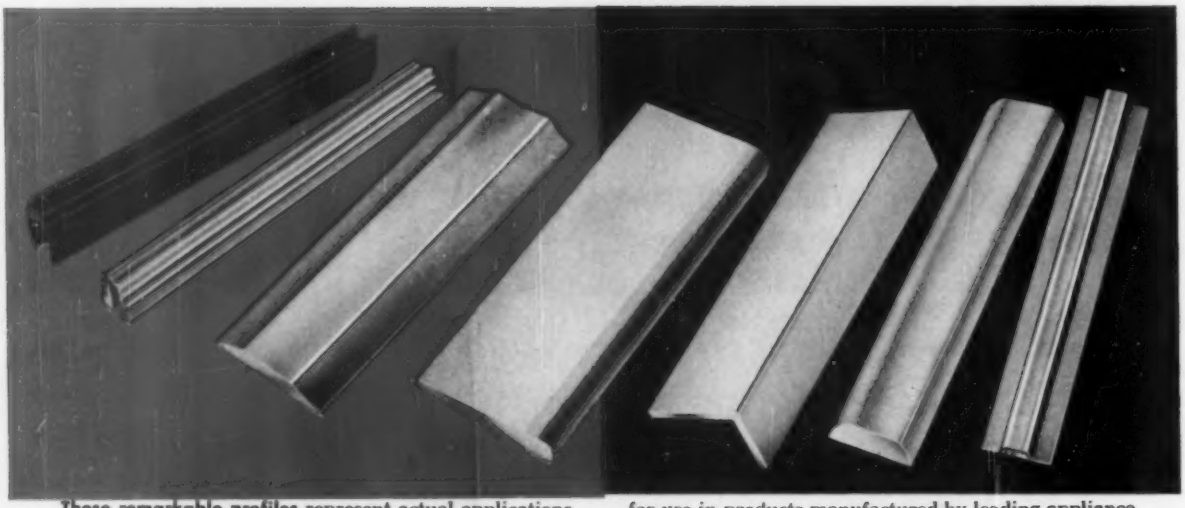
New ideas in NYLON



These remarkable profiles represent actual applications of Spencer Nylon 607 and 606. They were extruded for use in products manufactured by leading appliance, electronic, aircraft and automotive companies.

In complex extrusion applications . . .

Spencer High-Viscosity Nylons Do What No Other Nylons Can Do!

Every day, Spencer Nylon is being used for complex extruding operations in which no other type of nylon would work. This is because Spencer Nylon offers an outstanding range of properties for extrusion.

One secret of the Spencer Nylon's superiority is its ultra-high viscosity. Laboratory tests prove that the viscosity of new Spencer Nylon 607, for instance, is nearly three times that of any other nylon available.

Even the most irregular shapes can be extruded with Spencer Nylon. And these shapes are permanent. They aren't lost after leaving the die.

Extremely tough, yet resilient, Spencer Nylon is ideal for making precision engineered parts that must maintain their close tolerances under terrific abuse.

Other advantages of Spencer Nylon include: Outstanding draw-down characteristics, better abrasion resistance, higher stiffness, lower moisture absorption and extra-high impact strength. No pre-drying time is needed with Spencer Nylon. And, it can be used in conventional extrusion equipment.

You can choose the viscosity that fits your needs from Spencer's nylon extrusion resins. These resins are especially designed for profiles, shapes, tubing, film and coatings.

For more information about the properties of Spencer Nylon and a list of extruders now using it, contact Spencer Chemical Company at the address below.

SPENCER

SPENCER CHEMICAL COMPANY

SPENCER NYLON

SEE OUR CATALOG IN SWEET'S PRODUCT DESIGN FILE

WRITE FOR COPY

General Offices. DWIGHT BUILDING, KANSAS CITY 5, MISSOURI

NOSCO "CAN DO"

Molds Yesteryear's Traditions to Today's Modern Living . . .

Automatic Packaging is Bonus of "Can Do" Service . . .

Time honored products are a favorite victim of changes in tastes and living habits. Wyeth Laboratories learned that about their traditional transparent blue glass eye cup. That's why they turned to Nosco "Can Do."

The glass eye cup was an almost priceless symbol—backed by years of advertising and consumer acceptance. But it needed styling refinements to achieve a more modern cosmetic look. And could it be more durable to withstand the abuse of smaller, overcrowded medicine cabinets and possible falls on harder floors?

Nosco said "Can Do." The new molded plastic cup preserves identity by being an exact color match and retaining the basic lines. But Nosco's engineering know-how refined the style to give a more delicate appearance while actually increasing shock resistance. And unit price was held down by Nosco volume production—20,000 eye cups in a single 24-hour day.

But that wasn't all. Nosco "Can Do" means more than just engineering and production skills. It means *complete* service, *complete* facilities. Wyeth gains an added plus from this. Nosco automatically packages each eye cup in an individual plastic bag immediately after molding, thereby preserving its sterile qualities.

Does new competition have an advantage over *your* time honored product or package? Nosco can retain your traditions, while giving you the benefits of modern, lightweight plastics. For quality-controlled plastic products—either injection or blow-molded—contact the competent Nosco representative near you.

NOSCO plastics, inc. · erie 5, pa. *One of the world's great injection molders.*

An Open Letter

to Design Engineers regarding Dayton Improved Urethanes

by C. M. CHRISTIE, President, The Dayton Rubber Company

THE fabulous urethanes are the most versatile new products since Nylon. Their possibilities are almost beyond comprehension.

We know, because we have been pioneering new urethane formulations for many years. And the farther we go the more startling become our discoveries. The things Dayton Rubber *Improved Urethanes* can do are positively explosive in terms of new products and processes.

Today, Dayton *Improved Urethane* formulations . . . controlling weight, strength, density, texture and thermal characteristics . . . can be made at will. *We are the only company that covers the full spectrum of Urethane formulations in America* . . . and have a nationwide group of over 100 Dayton Industrial Products Sales Engineers to service your requirements.

Already, Dayton *Improved Urethanes* have been tailored to hundreds of separate and distinct applications ranging from toys and topper pads to motor mounts and missile parts. We can fashion urethane formulas to solve an almost limitless number of design problems.

Stafoam*, in the preformed flexible type, is a complete line of improved formulations in sheets, rolls and blocks with varying physical, chemical and thermal properties as desired.

For foamed-in-place applications, our research chemists have perfected Stafoam liquid prepolymers for both flexible and rigid foams in standard or custom formulations for every purpose. Our development of new slower-reacting chemicals has resulted in superior cell structure and process control. Automatic mixing and metering equipment designed by us is also available for a continuous foaming operation.

Daycollan*, our solid urethane, is compounded and cast to custom specifications and supplied as a finished mechanical component. All Daycollan has the common properties of high energy absorption, exceptional Shore hardness, tear strength and abrasion resistance.

Our research and development facilities are a *Headquarters for New Ideas.* Their purpose is to help you solve your design problems. Over the years, working with many of America's leading corporations, HNI has compiled extremely broad and documented technical data on urethanes.

We have an inspiring new book titled, "Dayton Rubber—Headquarters for New Ideas" . . . a fast moving report on what Dayton has done in the past and what it can do for you right now. In it, you find specific and interesting *Improved Urethane* applications.

I personally want you to have this book. It will be a profitable addition to your files, and an excellent aid in your investigation into the full potentialities of urethane.

Write directly to me on your letterhead. I'll see that you receive this fascinating and informative book by return mail. Executive Offices: The Dayton Rubber Company, Dayton 1, Ohio. West Coast inquiries should be directed to American Latex Products Corporation, Hawthorne, California.

*Registered Trademark

Daycollan® AND Stafoam®

made by THE DAYTON RUBBER COMPANY, Dayton, Ohio and its West Coast Division, AMERICAN LATEX PRODUCTS CORPORATION, Hawthorne, California

HEADQUARTERS FOR **NEW** IDEAS

Why Gilbert Plastics Uses Reed-Prentice Injection Machines Exclusively...

"Reed-Prentice gives us top performance and dependability," says Mr. Peter Preuss, Vice President of Gilbert Plastics in Kenilworth, New Jersey. "These REED presses help us get the jump on competition and have helped make Gilbert the largest manufacturer of tomato boats and berry baskets in the country. We've found through experience that Reed-Prentice machines can be counted on to deliver the high quality products we insist on here at Gilbert. REED machines have done more than their share toward building our reputation and growth."

Reed-Prentice injection machines can do the same rugged, dependable job for any molder who wants better, faster molding. REED engineering brings you the most advanced features in injection molding . . . machines designed for today's need with the capacity to handle future requirements as well. For example in the full REED line, you'll find these exclusive features:

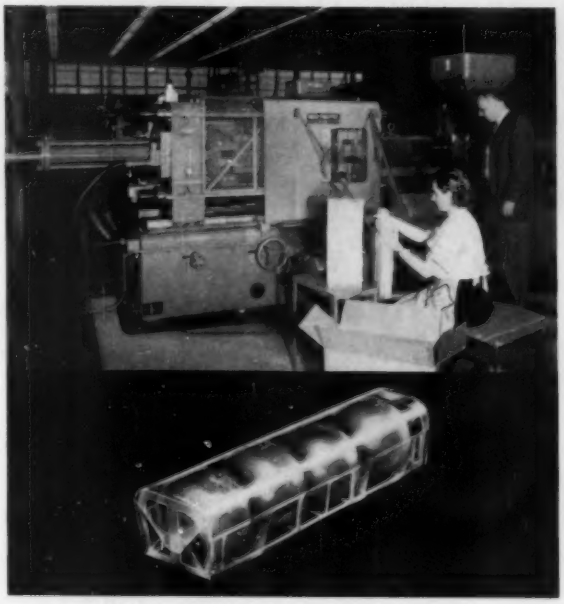
Low pressure die closing mechanism assures complete protection in automatic molding.

Hydraulic die space adjustment allows faster, easier mold setup.

Centralized controls put all controls at operator's fingertips.

Adjustable stroke offers greater flexibility, increases injection capacity.

For complete information and specifications on the full REED line of injection molding machines, call your nearest REED Sales Engineer today.



Above, one of the REED machines running the tomato boat on automatic operation. Below, is the finished product over-wrapped and ready for market.

REED-PRENTICE

division of **PACKAGE MACHINERY COMPANY**

EAST LONGMEADOW, MASSACHUSETTS

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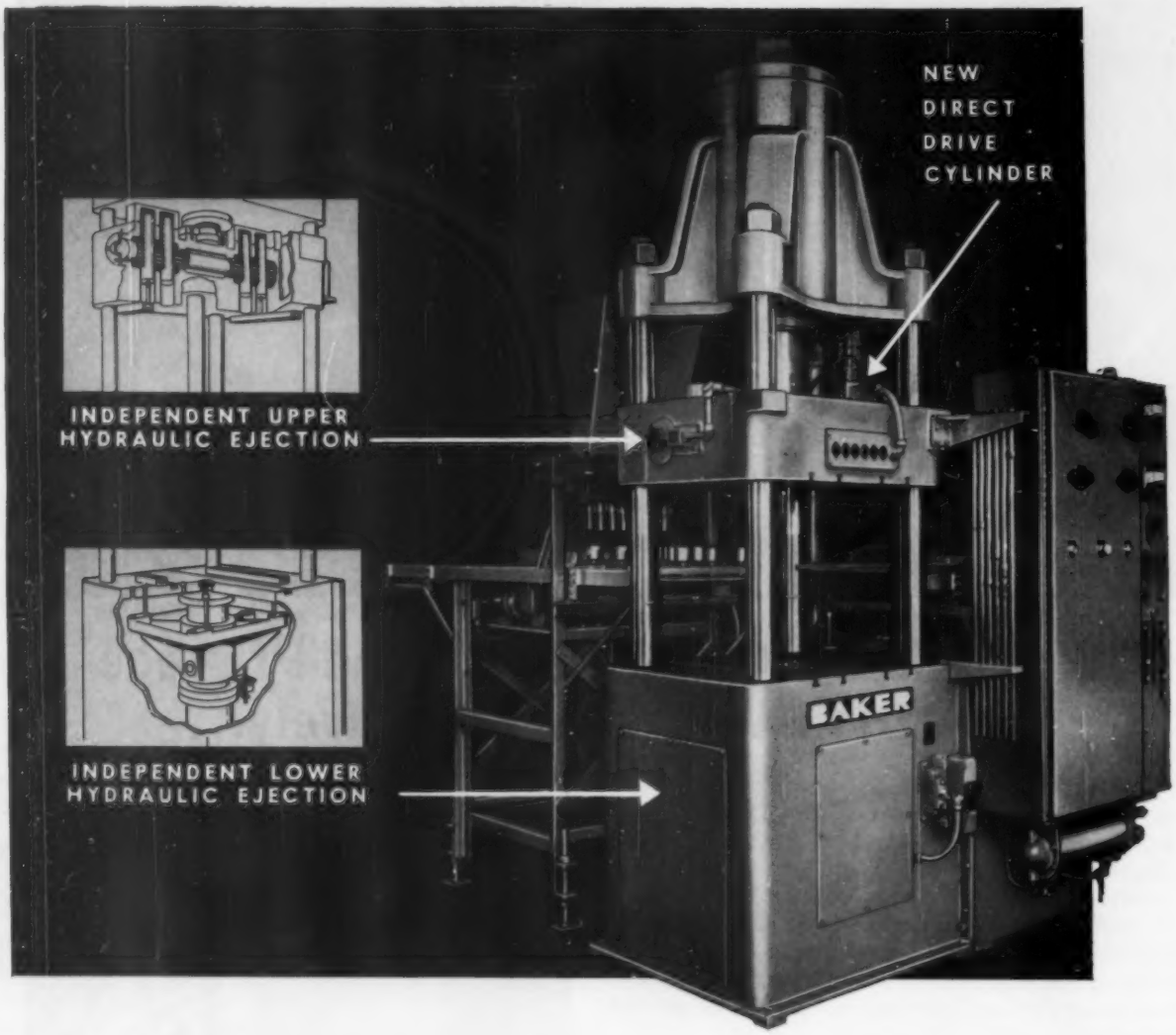

POSITIVE EJECTION ASSURES AUTOMATIC OPERATION FOR ANY TYPE PART

Only BAKER offers you independent lower and independent upper hydraulic ejection. As the press opens, both ejectors can operate each time. Lower ejectors follow part up to insure it stays on the force. When the press is open sufficiently, upper ejectors go all the way down and all the way up to remove parts to comb.

Lower ejection is the reverse with upper ejector holding part down and lower ejectors ejecting. Length of ejection stroke and time the ejection occurs are fully adjustable on each independent system.

No springs to adjust. Mold change over time is *tremendously* reduced over all other methods.

BAKER offers maximum flexibility in automatic plastic molding machines! For details on how BAKER Automatic Machines can modernize your production line, write BAKER BROTHERS, INC., Dept. OP-360, P.O. Box 101, Station "F," Toledo 10, Ohio.

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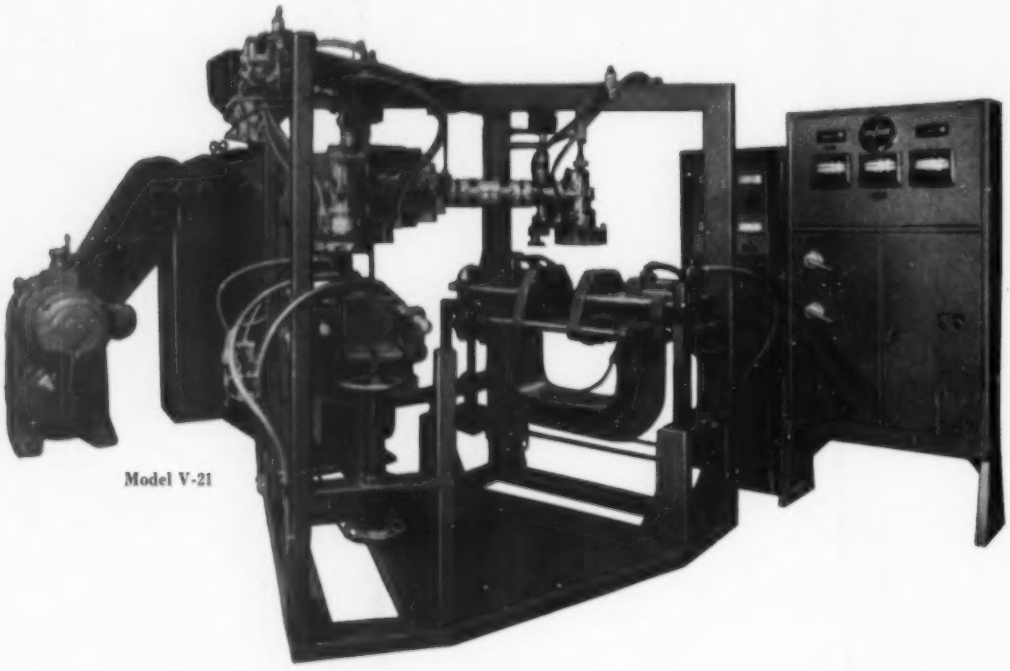

Model V-21

ANNOUNCING MPM DIVERSAMATIC TWIN-STATION BLOW MOLDING EQUIPMENT

To satisfy the high degree of technical excellence sought by the plastics industry, Modern Plastic Machinery Corporation introduces blow molding equipment of advanced design. Emerging from MPM's integrated development and manufacturing facilities comes the Diversamatic line of plastic production equipment. Now, molders who desire finest quality machinery can obtain complete systems of extruders and *royalty-free* blow molding equipment from one source—a respected company, known for products incorporating engineering sophistication and possessing highest performance reliability.

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MPM's Diversamatic Blow Molding Equipment may be inspected at the 1960 AMA PACKAGING SHOW, BOOTH #1527 and, thereafter, at the company's plant in Clifton, New Jersey. Inquiry is invited.

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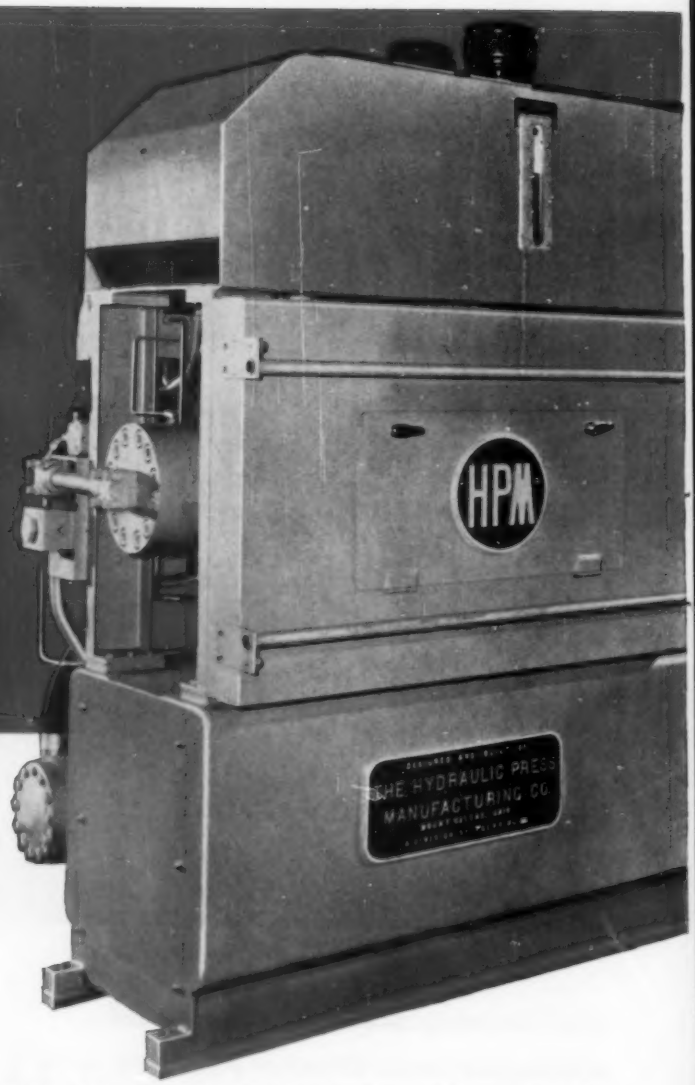
FOR
DEPENDABILITY
PERFORMANCE
PRICE & DESIGN

YOU CAN'T BEAT AN H-P-M



These Molders Tell Why....

DEPENDABILITY

George Kelly, Gen. Supt. Columbus Plastics Products, Inc. "Downtime is negligible on our H-P-Ms. On our new H-P-M 6 oz. machines, maintenance costs per year were 1/5 that of other machines we have."

PERFORMANCE

E. Ostrowsky, Plant Mgr. and Chief Engr., Federal Tool Corp. "Our H-P-M preplasticizers give us top performance as to speed of fill, overall cycle and overall quality."

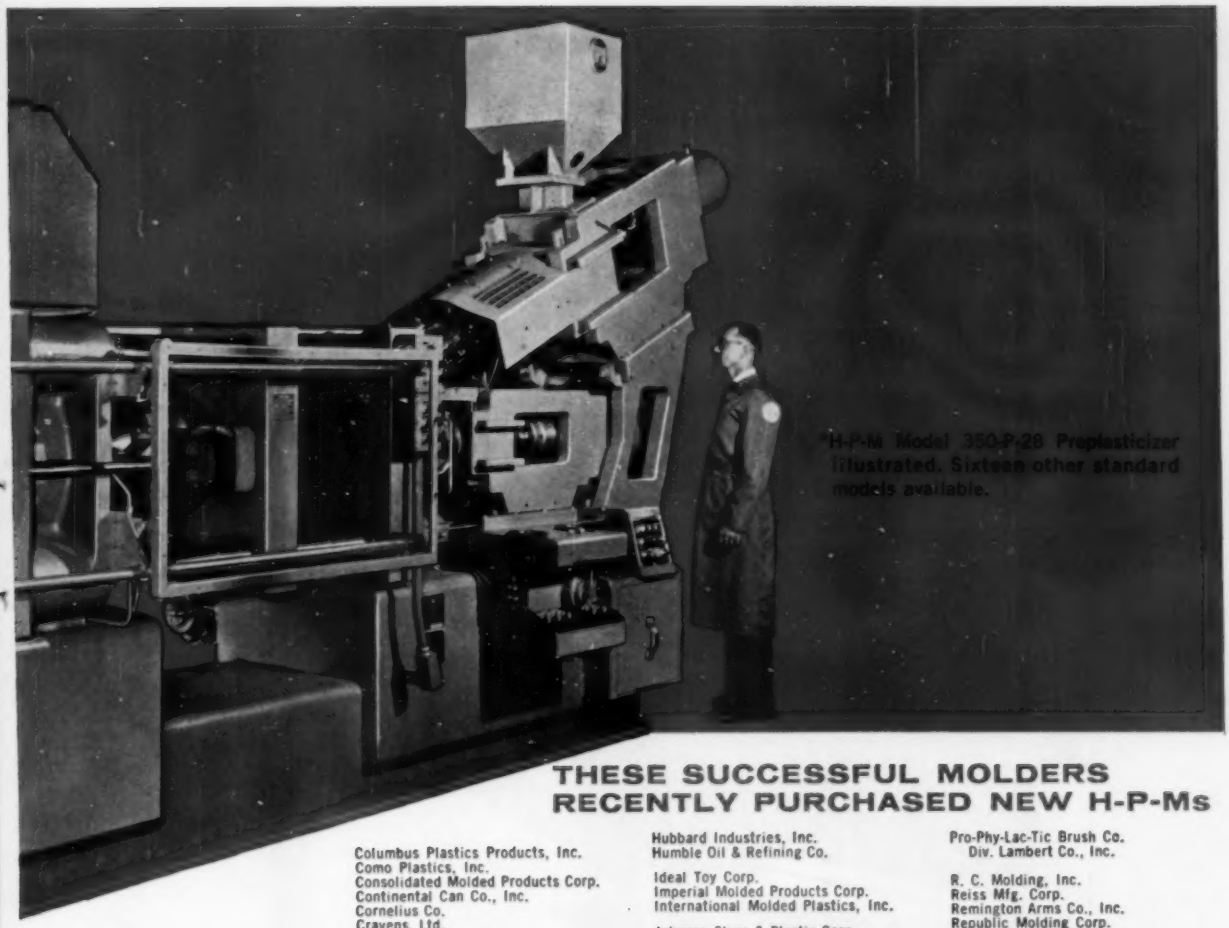
PRICE

John Fontenelli, Vice Pres. and General Mgr. Fibro Corp. "H-P-Ms are priced right. The reason we buy them is we get more machine for our dollar."

DESIGN

M. "Slim" Krajcik, Plastics Supt., Rubbermaid, Inc. "H-P-M's Preplasticizer is a well designed machine. I feel it's the machine of the future. We mold three cans on ours in the same time it took to mold two on another make machine."

IMMEDIATE DELIVERY AVAILABLE ON MOST MODELS



H-P-M Model 350-P-28 Preplasticizer illustrated. Sixteen other standard models available.

THESE SUCCESSFUL MOLDERS RECENTLY PURCHASED NEW H-P-Ms

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Ajax Die Casting Co.
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Allied Plastics Co.
Amberland Corp.
American Can Co. (Research Dept.)
American Cyanamid Co.
American Insulator of Delaware
American Molded Products Co., Inc.
American Molding Co.
American Plasticraft Co.
American Thermos Products Co.
Amity Plastics Corp.
Amos Molded Plastics
Amphenol-Borg Electronics Corp.
Ankney Co.
Atlantic Plastics, Inc.
Aux Forges de Vulcain

B & W Molded Plastics
Beacon Plastics Corp.
Bendix Aviation Corp.
Bernard Edwards Co.
Blackhawk Molding Co., Inc.
Blanke Plastics Co.
Bolta Products
Div. General Tire & Rubber Co., Inc.
Braun Hobar Corp.
Bremen Bearing, Inc.
Brittain Products Co., Inc.
Bruce Molded Plastics Products, Inc.
Burlington Molding Corp.

Canadian Thermos Products
Carzol Plastic Corp.
Cepco Plastics Co., Inc.
Circle Plastics Co., Inc.
City Auto Stamping Co.
Div. Globe Wernicke Industries, Inc.
Columbus Plastics Products, Inc.
Como Plastics, Inc.
Consolidated Molded Products Corp.
Continental Can Co., Inc.
Cornelius Co.
Cravens, Ltd.

Detroit Plastic Molding Co.
Detroit Plastic Tile Co., Inc.
Dole Valve Co.
Dynamic Plastics Corp.

Earl Fisher Plastics Co., Inc.
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Elgin Molded Plastic Co.
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Etan Products
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Ets. Allibert (France)
Everledge Mfg. Co., Inc.

F & B Mfg. Co.
Fabricon Products (Los Angeles)
Div. Eagle-Picher Co.
Fabricon Products (Philadelphia)
Fabricon Products (Detroit)
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Fibro Corp.
Field Mfg. Co.
Flambeau Plastics Corp.
Franklin Mfg. Co.

Gale Products
Div. Outboard Marine Corp.
General Die Mold Co., Inc.
General Electric Co.
General Industries Co., Inc.
General Molds & Plastics Corp.
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Harrison Radiator Div., G.M.C.
Hartland Plastics, Inc.
Hawk Model Co., Inc.
Heyman Mfg. Co., Inc.
Hoover Co.
House of Plastics, Inc.
Hubbard Industries, Inc.
Humble Oil & Refining Co.

Ideal Toy Corp.
Imperial Molded Products Corp.
International Molded Plastics, Inc.

Johnson Glass & Plastic Corp.

Ken Hagen Mfg. Co., Inc.
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A Division of Koehring Company • Mount Gilead, Ohio, U.S.A.

HPM

H-2

How to save money on your next press: apply your specs to a basic R. D. Wood design

The result will be exactly *what you want*—just as surely as if you had it designed from scratch. And its cost will be much lower. Working with numerous basic models, R. D. Wood engineers can save considerable design time and expense, and still incorporate *your* specifications in the finished machine. You're sure of its quality, too. For every Wood Press is built by experts using selected materials. This brings additional saving from smooth, dependable performance; fast, economical production; trouble-free operation. *Before* you begin planning your next hydraulic press, consult Wood.

R. D. Wood 2000 ton single opening molding press for the molding of abrasive wheels, and other similar molding and curing operations. Platen size—44" x 44". When molding abrasives, canvas boots protect columns and main ram from abrasive particles. Can be furnished with self-contained hydraulic pumping unit or arranged for accumulator operation.

R. D. WOOD COMPANY

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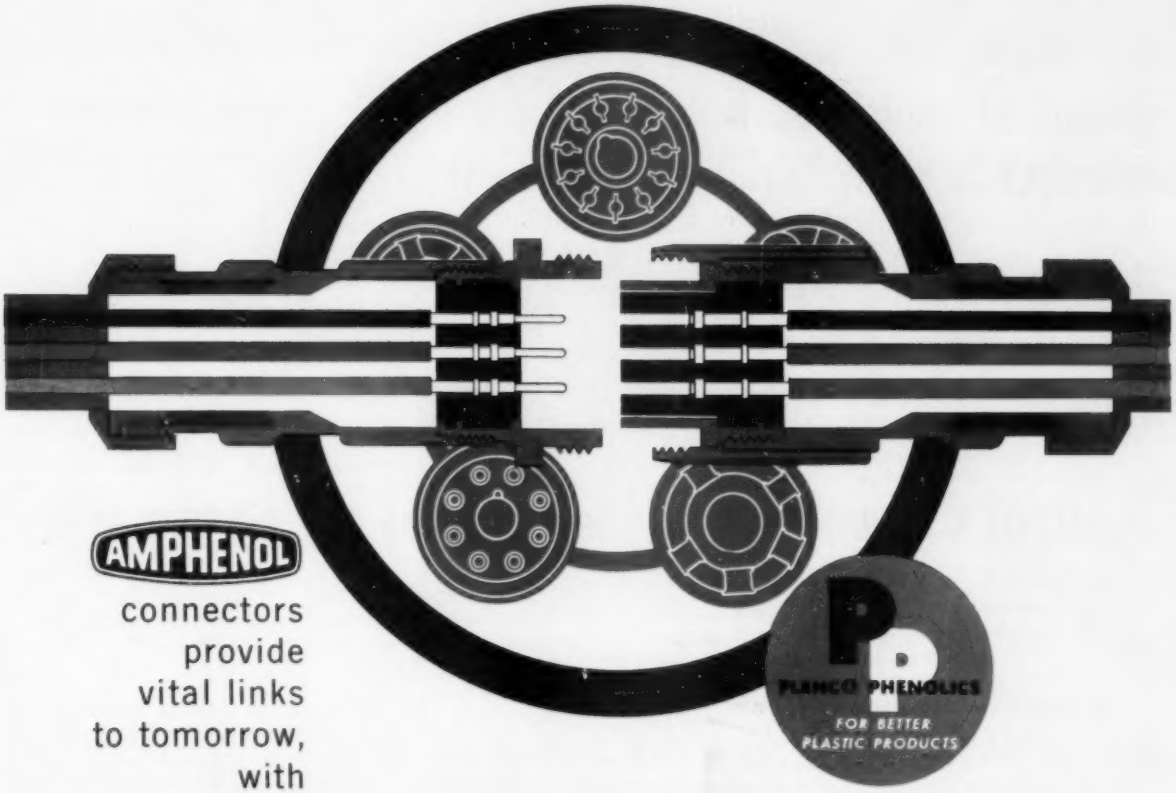

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provide
vital links
to tomorrow,
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the help
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phenolic molding compounds

IN MISSILES, in aircraft, in communications, computers, and other electronic equipment, all important *connectors* "hook up" to keep energy on the go. They have to be molded of materials that can stand up to high heat, extreme cold, rough handling.

Amphenol Connector Division of Amphenol-Borg Electronic Corporation, leading U.S. producer of these electromechanical components, finds the answer in the broad selection of Plenco *general-purpose* molding materials.

Plenco 300 G.P., for one. Developed for the widest range of applications and conditions, and specified for Amphenol connectors used by the radio, television, and electronics industry, as well as the military in testing apparatus and transmitting/receiving equipment. To them, Plenco 300 G.P. assures topmost electrical, mechanical, and physical properties.

Ready-made *or* specially-made, Plenco phenolic molding materials have the answer to your product or production requirements. Call on us at any time—for consultation, demonstration, prompt and dependable service.

PLASTICS ENGINEERING COMPANY

Sheboygan, Wisconsin

Serving the plastics industry in the manufacture of high grade phenolic molding compounds, industrial resins and coating resins.

IN
APPLICATIONS
FROM

NUODEX stabilizer know-how assures top performance

and provides you with the building blocks for highest quality in your product line at minimum cost.

Whatever your process—plastisols, extrusion, calendering—turn to Nuodex application research for Vinyl Stabilization Systems which provide maximum heat and light stability at lowest cost.

Nuodex technical specialists have solved many difficult stability problems by developing systems made up of specific combinations of tested and proved Nuostabes®, three of which are basic. Nuostabe V-132, a Barium-Cadmium complex; Nuostabe V-142, an organic chelator; and Nuostabe V-152, a Zinc complex. Complementing this primary group, Nuodex offers a full line of "Uniformity Certified" stabilizers for special applications including the economical *liquid* Barium-Zinc complexes, Nuostabes V-12 and V-14.

Nuodex application research, backed by a fully staffed laboratory, is prepared to help you cut your production costs by developing systems to meet your specific needs. To assure you of a dependable source of supply, Nuodex also maintains a network of strategically located warehouses and sales offices throughout the country.

For complete product specification data, write to

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Fungicides • Nickel Salts • Organic Peroxides • Paint Additives • Stearates • Vinyl Additives

U.S.I. POLYETHYLENE NEWS

A series for plastics and packaging executives by the makers of PETROTHENE® polyethylene resins

MARCH, 1959 — U. S. Industrial Chemicals Co., Division of National Distillers and Chemical Corporation — 99 Park Ave., N. Y. 16, N. Y.

Packaging Notes

A polyethylene-paper pouch for cake mixes permits savings in packaging materials and labor for a Canadian producer. The savings enabled the firm to lower the retail price of its product from 29 to 19 cents a package. The product was previously packaged in plain paper pouches stuffed in cartons.

The new 15 oz. package consists of a paper container with four-color printing on the outside and a 1.75 mil polyethylene lining on the inside. The package is produced by feeding separate rolls of paper and polyethylene film into a converting machine. The two-layered pouch is filled as it is formed.

Polyethylene film insert forms inner compartment of a disposable wirebound wooden liquid container. The new lightweight 15-gal. container consists of a polyethylene liner within a corrugated cardboard cushion. The outer surface is a wire-bound wooden box which provides rigidity and strength.

Easy emptying is provided by a flexible, pull-out pouring spout. The manufacturer claims many advantages over glass-type carboys, which cost an average of $2.50 to $6.00 per trip.

Initial cost of the new "carboy" is 20% lower than glass-type carboys, and it eliminates return freight costs, cleaning repairs, double bookkeeping and inventory. The new containers occupy half the space and are 51 lbs. lighter than glass carboys.

The containers are said to meet industry standards for safe handling and shipping.

A polyethylene package is now replacing tin cans for packaging sterilized milk produced by a west coast dairy. Combined cost of container, filling, and shipping of the tetrahedral-shaped packages is said to be half that of standard metal cans... the only previous method for storing sterilized milk indefinitely without refrigeration. The new package creates a gas barrier comparable to that of a metal can. It has possibilities for many products which normally require refrigeration for preservation.

The package walls consist of a four-ply lamination of paper, a polyethylene extrusion, metal foil, and polyethylene film inside. The foil, surrounded by polyethylene, is used in the pyramid-shaped packages in such a way as to provide an absolute barrier.

Aseptic methods, including a chlorine wash, are used before packaging to eliminate all contaminants from product and package. The package is filled slightly above the "full" line.

When the heat sealing jaws close, a filled, hermetically sealed container results, with no residual air pocket.

Be sure to visit the
U.S.I. EXHIBIT — BOOTH 1231
29th NATIONAL
PACKAGING EXPOSITION
CONVENTION HALL, APRIL 4-7
ATLANTIC CITY, NEW JERSEY

U.S.I. Technical Specialists to Answer Questions on Polyethylene at Exposition

Cast Polyethylene Film to be Shown at Atlantic City Show

Record attendance is expected at the American Management Association's 29th Annual National Packaging Exposition, April 4-7, at Atlantic City's Convention Hall. U.S.I. will occupy space on the lower level at Booth 1231, where visitors will again be invited to take advantage of U.S.I.'s Technical Information Center on polyethylene film. In a departure from normal industry practice of manning such exhibits primarily with sales personnel, it has been U.S.I.'s custom to offer the services of trained technical specialists who are well versed in polyethylene technology as it applies to packaging applications of a wide variety.

Last year's packaging show featured the Technical Information Center, above. U.S.I. representatives will be available again this year to answer questions on polyethylene packaging.

This year, members of U.S.I.'s Polymer Service Laboratory will be on hand to advise converters and packagers on such problems as the proper selection of polyethylene film most satisfactory for a given application, and heat sealing methods and equipment. Other questions of interest to packagers of baked goods, drug products, meat and poultry, produce and soft goods will also be answered.

Applications of Cast Film to be Shown

This year's Atlantic City Exposition will be the second anniversary of U.S.I.'s introduction of cast polyethylene film. Cast film and its latest applications will again be a part of U.S.I.'s exhibit. Packagers are encouraged to make use of this opportunity to discuss innovations in polyethylene packaging that have developed in the past year.

New Resin to be Introduced

A new resin, tailored to those packaging applications that demand a combination of high toughness with high clarity and gloss, will be demonstrated.

New Automatic Machine for Packaging With Polyethylene

A new polyethylene bagging machine designed for fine-line edge sealing was recently introduced for packaging both rigid and non-rigid products. The machine automatically forms the bag from flat film around the object to be packaged.

Because packages are sealed on three sides, there are no seams to mar either side of the bags. The entire surface of each side of the package is available for printing, and placement of seals also offers complete product visibility.

A special intake conveyor will accommodate from 1 to 5 bag loading stations, and feeds filled packages into an automatic heat sealer which makes seals immediately adjacent to the product. The new machine is said to handle from 10 to 100 packages per minute.

U.S.I. Announces Booklet On Polyethylene Printing

"Printing of Polyethylene" is the title of a new U.S.I. booklet just off the press. It's the latest addition to special U.S.I. literature designed to help achieve finest results with polyethylene packaging film.

The new booklet discusses methods of film treatment, printing techniques, printing inks, and field test procedures. It also contains a glossary of commonly-used ink and printing terms.

A copy of this valuable 16-page booklet is available upon request. Just write to U.S.I. Polyethylene News, U. S. Industrial Chemicals Co., 99 Park Ave., New York 16, New York.

Polyethylene Valuable for Rice Field Levees

A Texas agricultural station is experimenting with polyethylene sheeting for use in rice field levees.

The film or sheeting used is black polyethylene, 3 ft. wide. Various thicknesses are being tried in the experiments. It is anchored in place by dirt, back-plowed along its lower edge. Further support comes from 1" x 4" stakes placed 5-10 ft. apart. The levee withstands substantial winds and a 5-in. head of water.

The researchers report many advantages of the polyethylene levees. They eliminate dirt levees which take 4-10% of available acreage and are prone to germinate undesirable grasses and weeds. The levees also make possible the harvesting of rice fields in single units, rather than by following the contours of dirt levees.

U.S.I.

Series 5, No. 2

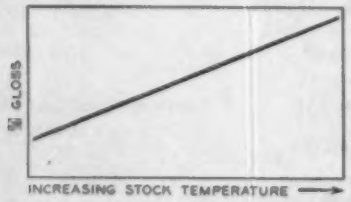
POLYETHYLENE PROCESSING TIPS

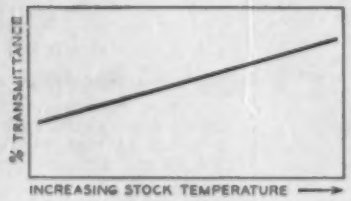
HOW STOCK TEMPERATURE AFFECTS THE OPTICAL PROPERTIES OF CAST FILM

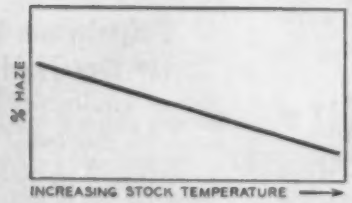
Stock temperature is a key factor among operating variables affecting the optical properties of cast polyethylene film. Fortunately, the extruder can control stock temperature with a high degree of accuracy to produce film of optimum gloss and transparency and minimum haze.

Gloss is generally defined as the percent light reflected at an angle from the surface of the film, as determined by standard measuring techniques. Transparency, or transmittance, is the percent light which will pass through the film. Haze is the percent light scattered as it passes through the film.

The graphs below show the general effect on these vital optical properties with changes in stock temperature.



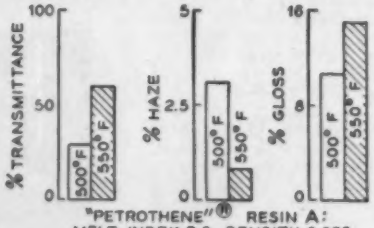




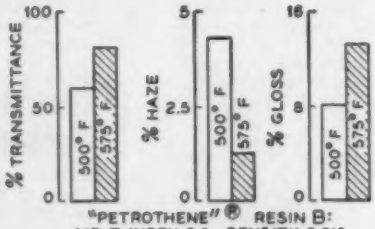
Effect Varies With Resin

Within limits, the amount of change in the film's optical characteristics brought about by raising or lowering the temperature varies with the resin being processed. In some cases, for example, improvements of 50% or more in gloss and transmittance result from increased temperature. Similarly, a 75% reduction in haze is sometimes possible. These results are much greater than would be expected from the above graphs of the general effect.

The following bar graphs show examples where temperature increases of 50°F and 75°F greatly improved the clarity of films of two different resins.



"PETROTHENE"® RESIN A:
MELT INDEX 2.0, DENSITY 0.928



"PETROTHENE"® RESIN B:
MELT INDEX 8.0, DENSITY 0.915

These differences in films produced at different temperatures also underscore the need to keep resin temperature uniform. (See U.S.I. Polyethylene Processing Tips, Vol. V, No. 1 for a detailed discussion of the importance of stock temperature control.)

Balanced Extrusion Conditions Necessary

In the production of cast film, the requirements of the end use are most often the major consideration. To achieve the desired film properties with the equipment available, the extruder must concern himself not only with stock temperature, but with the establishment of a balance of extrusion conditions and resin properties.

U.S.I. technical service engineers will be glad to work with you in determining the best stock temperature for your operation. Ask for their assistance on this or other processing problems.

U.S.I. INDUSTRIAL CHEMICALS CO.
Division of National Distillers and Chemical Corp.
99 Park Ave., New York 16, N. Y.
Branches in principal cities

U.S.I. HELPS IMPROVE CLARITY OF POLYETHYLENE PACKAGING FILM

. . . helps expand your markets for it, too

From shirts to sugar cookies . . . your customers are finding their products look better, sell better when packaged in polyethylene. You can now produce polyethylene film with better clarity than ever before thanks in large part to these U.S.I. research and development services:

FINER RESINS

U.S.I. has developed a number of different PETROTHENE® resins . . . so that you can produce polyethylene film with a complete range of toughness and clarity to suit any end use. These resins are manufactured under rigid quality control conditions to assure resins of the highest uniformity for packaging use. To help you obtain maximum results from these resins, U.S.I. offers literature containing tables and technical information to assist you in choosing the most suitable resin for your particular applications.

NEW PRODUCTION TECHNIQUES

Engineers at U.S.I. are constantly seeking methods for producing better films with PETROTHENE resins. The clearest polyethylene film available today is made by a chill-roll casting process which U.S.I. pioneered. Cast film offers unprecedented clarity and gloss without sacrificing needed strength. Since its development, the process has sparked many new uses for polyethylene film.

U.S.I. has also contributed to higher clarity in blown tubular film with a new annealing chamber technique for film extrusion. When properly used, the technique produces blown film of markedly improved clarity, with practically no impairment of other physical properties.

TECHNICAL ASSISTANCE

A Polymer Service Laboratory is maintained by U.S.I. to help extruders solve production and processing problems. Experienced Technical Service Engineers will be glad to work closely with you on evaluating new resins and assist you in any processing problems. This service is confidential and without obligation.

A wealth of technical literature is also available from U.S.I. to help you take full advantage of the quality of PETROTHENE resins. These booklets cover many phases of processing and use of polyethylene and are available upon request.

ADVERTISING AND SALES PROMOTION

U.S.I. conducts a coordinated advertising and sales promotion program which is designed to help build markets for your polyethylene products. Advertisements directed to *your* customers and prospects appear in leading magazines in the baking, produce, candy, dairy, apparel and food fields. Other U.S.I. polyethylene packaging literature reaches film users and package designers regularly by direct mail.

U.S.I. ads appear in leading magazines to help build your markets for polyethylene film.

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GUIDE TO LITERATURE ON PETROTHENE POLYETHYLENE RESINS

U.S.I. offers a wealth of literature on its PETROTHENE Polyethylene Resins, ranging from complete processing information to sales and application advice on polyethylene packaging materials and molded goods.

Listed below are the titles currently available. We'll be happy to send you any that you select. Address your request to: U. S. Industrial Chemicals Co., Division of National Distillers and Chemical Corp., 99 Park Avenue, New York 16, New York, or to your nearest U.S.I. sales office listed below.

TECHNICAL BROCHURES

PETROTHENE Polyethylene — a Processing Guide
Polyethylene Processing Tips File Folder
Polyethylene "Shutdown" Resin — PETROTHENE 205-1
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Cast Film
Annealing Chamber Improves Optical Properties
Which Polyethylene Film Should I Use
Polyethylene Bag Calculator (Domestic)
Polyethylene Bag Calculator (Metric)
Printing of Polyethylene
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Formulas and Tables for Polyethylene Film and Bags (English Units)
Formulas and Tables for Polyethylene Film and Bags (Metric Units)

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Just tell us the nature of the material—polyester, acrylic, fiber glass, rubber, or whatever—and give us your production specifications. We'll build the right compression molding press to meet your needs.

Erie Foundry regularly builds hydraulic molding presses in capacities of 25 to 4,000 tons. Our advanced design control systems will apply forces accurately and precisely, maintain platen temperatures within close tolerances, and perform molding cycles with split-second timing. Versatility is built in so that a wide range of molding jobs can be handled.

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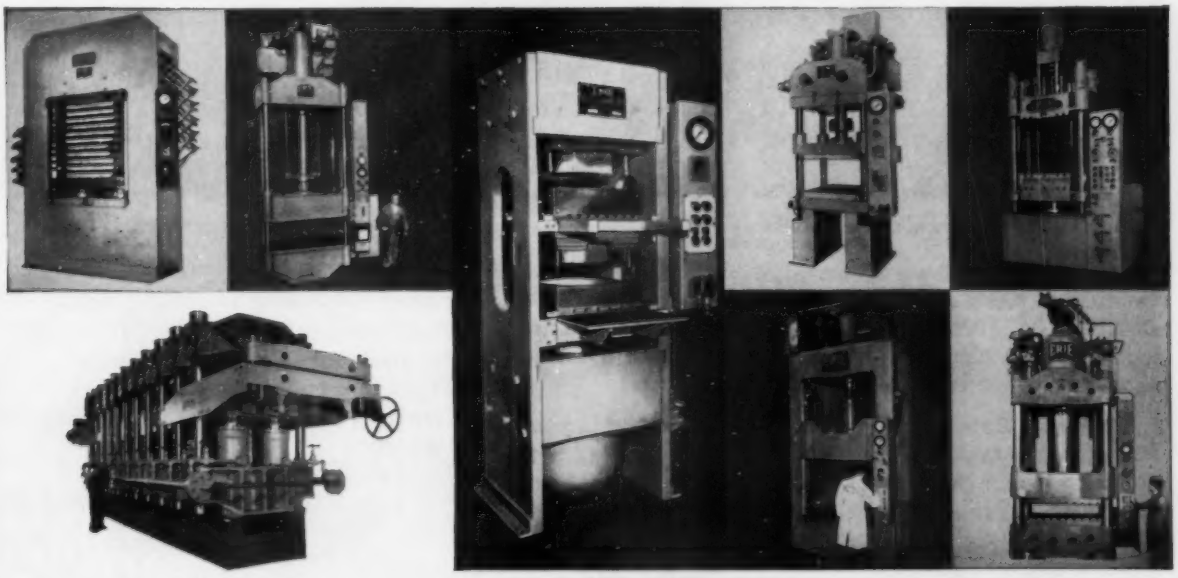
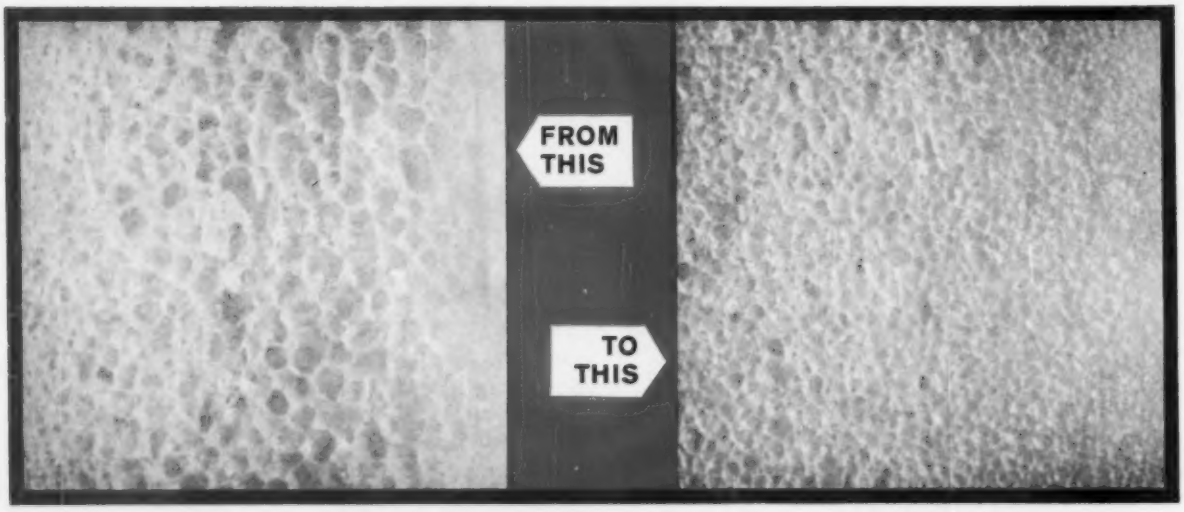


ANNOUNCING:

New Conoco DEMIVIS* for vinyl foam



Foam made with a conventional sulfonate

Foam made with CONOCO DEMIVIS

Continental Oil Company announces a new product . . . CONOCO DEMIVIS. It is a synthetic calcium sulfonate in a plasticized system for use in making open-cell vinyl foam in which blowing is completed before gelation.

Investigate the possibilities for CONOCO DEMIVIS in your operations. Actual tests prove that this outstanding new product makes a finer, more uniform foam cell than foam made with natural sulfonates diluted in mineral oil.

Its many outstanding advantages include:

- Greater compatibility with PVC resins
- No exudation or spewing problems
- Wider range of primary plasticizers
- Low viscosity for easier handling, accurate measuring
- Light color results in whiter foams

CONOCO DEMIVIS is available in commercial quantities today for prompt delivery.

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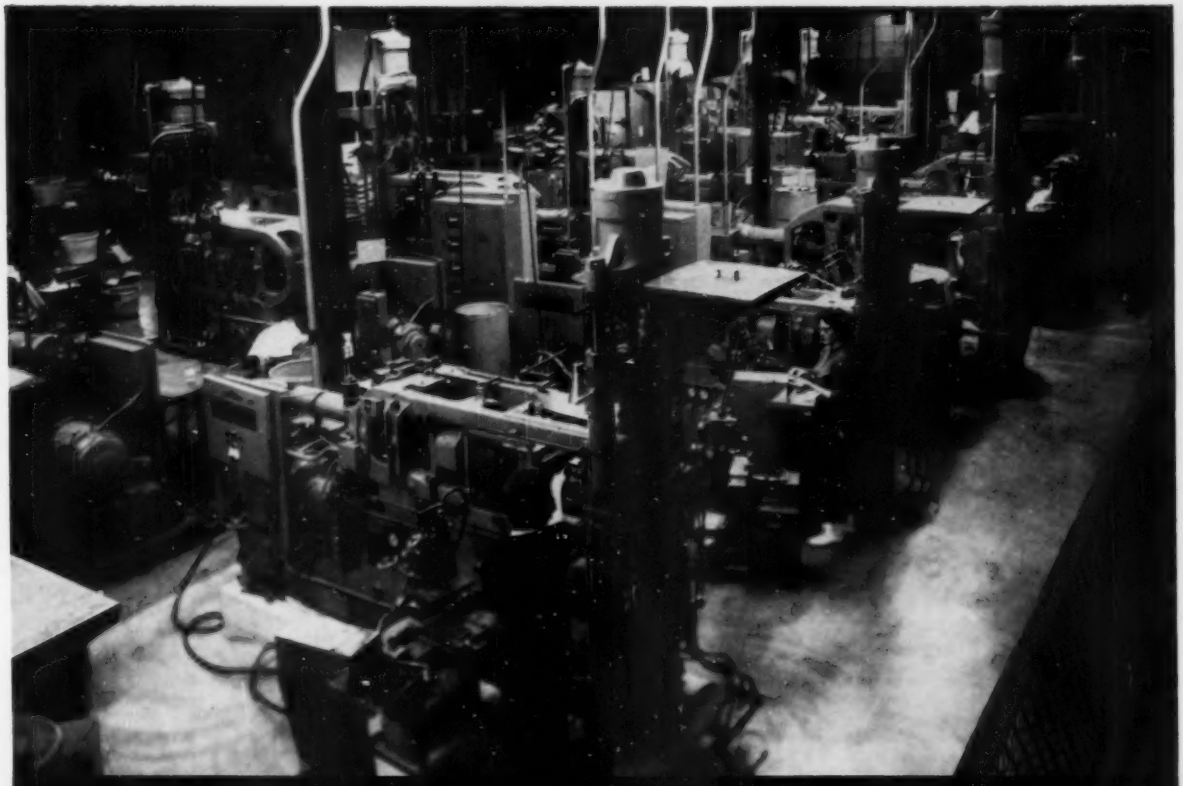


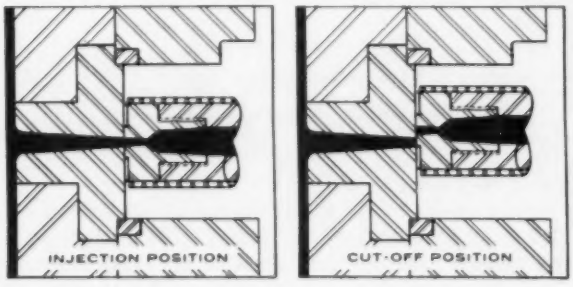
Here's a shop with 14 LESTERS ALL RUNNING NYLON

Wherever nylon is being molded expertly and in quantity, it is most likely being run on Lesters. An exceptional example of this fact is Nyloncraft, Inc. in South Bend, Indiana, where 14 Lesters are in constant production on nylon. Why has this growing, vigorous, 3-year-old company based its entire success in molding nylon on Lester equipment?

The answer is simple: the Lester vertical injection assembly incorporates the unique nylon cut-off attachment—when the plunger returns after making the shot, it lifts the injection cylinder. The flat nozzle is moved out of register with the sprue bushing, providing a positive, mechanical method for effectively controlling nozzle drool.

Moreover, the vertical injection cylinder allows the use of the exclusive internal heater which, as part of 4-zone heating control, gives pin-point accuracy in controlling the material plasticization.

These advantages in molding nylon can be yours on any Lester model from 4/6 ounce to 24/32 ounce capacity. Write for detailed specifications.



For a new slant on one problem of injection molding, write for your FREE copy of "Tom Swiftly and his Timed Machines."

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Blow Molding Machines
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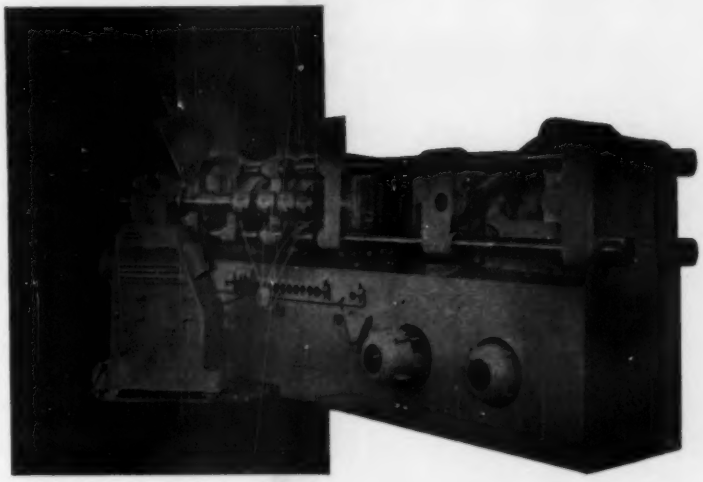
1 1/4" 1 3/4" 2 1/2" 3 1/2" and 6" approx)

INJECTION MOLDING MACHINES

from 1/10 oz. upwards

with
SCREW PLASTICIZING
UNIT
from 1 – 350 OZS



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Brunswick Finds Operations Profitable in VIRGINIA

OUTPUT DIVERSIFIED: Modern bowling equipment, school equipment and aircraft and missile components are produced at Brunswick's Marion plant, with production equally divided between plastic and wood. Shipments total 350 carloads per month.

EMPLOYMENT UP: An original work force of 177 has steadily increased to 1,450 employees in 1960. Local experience in plastics and woodworking was a factor in Brunswick's selection of Marion, Virginia, for its production facility.

PRODUCTION SOARS: Brunswick aircraft and missile components for defense are up sharply in production, as is school equipment. Bowling lane production has increased from 2,500 annually to 12,000. And the 325,000 sq. ft. plant has ample acreage for expansion. Another Brunswick facility, a 169,000 sq. ft. warehouse, is located at nearby Damascus, Virginia.

Nearness to raw materials was an important factor in Brunswick-Balke-Collender's choice of a plant site. Today at Marion, Virginia, Brunswick uses 2½ to 3 million gallons of water per month from a river running by the plant . . . 40,000 tons of coal a year from mines only 40 miles away.

Abundant raw materials . . . and power . . . plus the dependability and vigor of its Virginia employees . . . have paid dividends to Brunswick. Employment has increased more than 8-fold, electrical use has doubled, plant and warehouse space has been increased more than 50%. Brunswick-Balke-Collender has found operations profitable in Virginia!

Let us tell you why so many companies are locating in Virginia. Phone, wire, write or visit in complete confidence . . .

C. M. Nicholson, Jr., Commissioner
Division of Industrial Development
Virginia Dept. of Conservation and Economic Development
State Office Bldg., Richmond, Va.
Phone MIlton 4-4111 Ext. 2255

You, too, can find these... and many other great competitive advantages in **VIRGINIA**
... a wonderful place to play or work

NEW DESIGNS IN MARLEX

Modern Ice Cream Freezers made with MARLEX*

An up-to-date version of an old-time favorite, these new ice cream freezers depend on MARLEX to make them permanently water-tight . . . virtually unbreakable . . . free from rot and mildew . . . rustproof . . . and less costly to manufacture.

The Richmond Cedar Works Manufacturing Corporation of Richmond, Virginia, first used a glass-resin laminate for the outer tub of their new freezer models. However, these tubs tended to crack and separate with use. Outer tubs made of MARLEX 5040 Resin were the answer both from the standpoint of performance and cost. Molded by American Insulator Corporation, New Freedom, Pennsylvania, these new MARLEX tubs are unaffected by freezing temperatures and salted ice . . . lighter . . . more durable with higher impact strength . . . and more attractive, in white or with decorator colors molded in. The President of Richmond, Mr. Frederic Jay, adds: "We find MARLEX such a good material from the standpoint of cost, manufacturing, and product excellence that we are planning to use it for other items."

Every day more manufacturers are relying on MARLEX Linear Polyethylene to improve products and reduce manufacturing costs. This high-quality plastic is rigid, tough, durable, colorful, lightweight. It has excellent electrical properties . . . superior resistance to heat and cold, 250°F to −180°F. It is unaffected by most acids, chemicals, oils, greases . . . cannot rust, rot or corrode. In fact, no other type of material serves so well and so economically for so many diverse applications. For details on MARLEX and how it can serve you, contact the nearest office listed below.

*MARLEX is a trademark for Phillips family of olefin polymers.

PHILLIPS CHEMICAL COMPANY, Bartlesville, Oklahoma, a subsidiary of Phillips Petroleum Company

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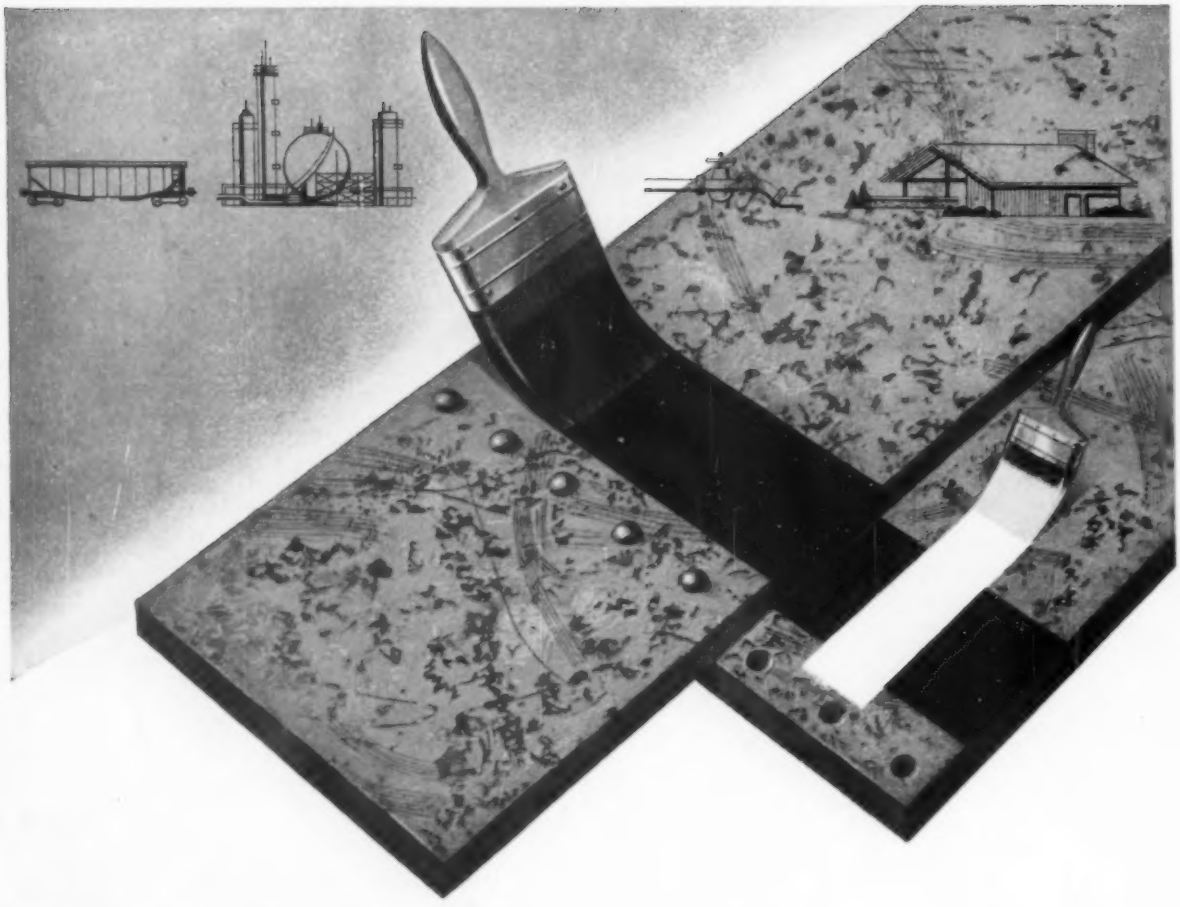
PHILLIPS 66 MARLEX PLASTIC



Important new development!

EPON® RESIN-BITUMEN C COATING— cold blend, high thermal stability

Now—for the first time—you can obtain complete compatibility between Epon resin and a heavy petroleum fraction.

Shell Chemical research has made it possible for you to combine Epon 828 liquid resin with a low-cost, petroleum-based material, *Bitumen C*. The resulting surface coating has a number of excellent properties never before attainable in a bituminous coating material:

- **Cold blending—no heating of pitch necessary**
- **Various film builds—up to 15 mils in one coat**
- **No pinholing—even in thin films**
- **Can be overcoated with white**
- **Imparts high thermal stability to bituminous coatings**
- **Permits use of conventional curing agents**
- **2-hour pot life**

This outstanding new Epon resin-Bitumen C coating is ideal for a wide range of anti-corrosion and waterproofing applications. To suggest just a few: pipelines, chemical plants, hopper cars, sewer pipe, waterproofing basements.

Both Bitumen C and Epon resin are available from Shell Chemical. Get off to a head start on this extraordinary new surface coating development by getting complete information. Write or phone your nearest Shell Chemical district office.

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THE PLASTISCOPE*

News and interpretations of the news — By R. L. Van Boskirk

Section 1 — **March 1960**

Styrene monomer boom. When styrene plastics consumption grew from around 650 million lb. in 1957 to approximately 900 million in 1959 with the prospect of a billion lb. in 1960 it was a cinch that monomer expansion would follow.

Total capacity of monomer when the government plants were sold was around 1 billion pounds. About 500 million lb. has been added, and it looks like another 700 million will soon be on the way. Of the 1½ billion lb. produced in 1959 some 850 million lb. are thought to have gone into styrene plastics and coating resins; perhaps 50 million for polyesters; a small portion for ion exchange; and most of the balance for synthetic rubber and exports.

What about price for styrene monomer? The price of styrene monomer today is 12.17¢/lb. On July 1, 1957 styrene producers signed a five-year contract with rubber companies to sell monomer at 12¢, plus an escalator clause that would allow slight increases to compensate for increases in costs. It had risen to 12.7¢ by January 1, 1959 when it was cut back to 12.0¢, but rising costs in 1959 brought it back to the level 12.17 cents.

During war-time government operation, bookkeeping cost of actual production, without overhead, was figured at 9 cents. Since the plants were sold, private owners have probably decreased production costs by improved methods, and the plants are now supposed to be more efficient. While construction cost of new plants is extremely high, the cost of benzene needed for production of styrene is perhaps the most important factor in determining styrene prices. At one time petroleum benzene was as high as 55¢/gal., but gradually came down to meet the price of benzene derived from coking. That price was as low as 31¢ in 1959—a recent price raise will make it 34 cents. That 34¢ price for benzene means that the escalator price of 12.17¢ will probably go up about July 1, 1960.

Effect of rubber on styrene prices. Styrene producers have their eye on the expiration date of the contract with rubber producers in 1962. Rubber manufacturers will undoubtedly press for a lower price on threat of making their own. Styrene producers don't like competition from rubber producers in this field. Even though plastics is now the biggest consumer, the styrene monomer producers still welcome big customers like the rubber companies. It isn't likely that they will raise the price of monomer for rubber. Consequently it won't be raised for plastics, and polystyrene will probably continue to be the lowest cost thermoplastic on the market for a long time to come. And there'll be plenty.

Who is adding capacity? Monsanto announced an increase in styrene monomer capacity late in 1959—total will be around 560 million lb. compared to former 360 million. Dow has announced an increase to 800 million—was (To page 39)

*Reg. U.S. Pat. Off.

CAMPCO PROGRESS

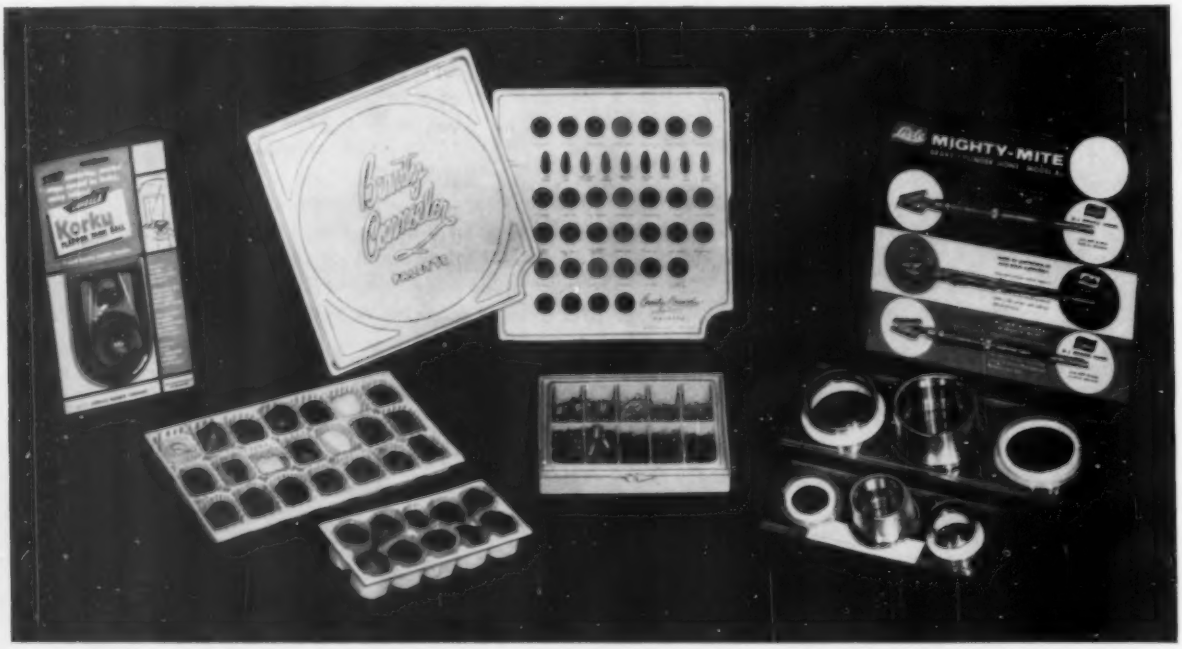
latest developments in plastic sheet · film · fabrication

Quality Packaging Begins with CAMPCO Thermoplastic Sheet and Film

BUTYRATE • ACETATE • STYRENE • POLYETHYLENE

Whatever the end use, the selling power of a package must rely upon the "hidden" qualities of the material from which it is made . . . strength, clarity, moisture-resistance, dimensional stability as dictated by the product.

To this end Campco has developed materials that can be depended upon to meet your packaging requirements in every respect. That's why it will be to your advantage to specify one of these Campco products: CAMPCO B-120 Cellulose Butyrate, in gauges from .005" to .125" in transparent 22" wide stock sheets and rolls, also available in custom sheets and rolls. CAMPCO A-130 Cellulose Acetate in gauges from .005" to .060" in transparent, stock roll 22" wide, also custom sheets and rolls up to 48" wide; CAMPCO PE-200 Linear Polyethylene ranging from .020" to .250" in custom sheets, also rolls up to .050"; CAMPCO S-540 Rubber Modified Styrene available in translucent and opaque in gauges from .010" to .187" in custom sheets, stock sheets available in white opaque. Don't be satisfied with anything less. Specify CAMPCO.



See interesting CAMPCO applications at the NPE

Be sure to visit the CAMPCO Booth, No. 1005, at the National Packaging Show. You'll see many outstanding applications utilizing CAMPCO thermoplastic materials. Included are case histories of applications in the packaging of industrial, consumer and pharmaceutical products, many of which are setting new "highs" in quality and appearance.

Ask about the Package Designers Contest

Package Designers visiting the N P E are invited to participate in the "Design With Campco" contest being held at the CAMPCO exhibit. Share your packaging problems with CAMPCO technical representatives on hand to discuss your needs.

Received Your Campco Personal File?

This data-packed reference file on thermo-plastic sheet and film is yours on request—just send name and address on Company letterhead to Campco, 2717H Normandy Avenue, Chicago 35, Illinois.

CAMPCO Sheet and Film
a Division of Chicago Molded Products Corp.

THE PLASTISCOPE

(*Continued from page 37*)

formerly around 500. Both the Freeport, Texas and Midland, Mich. divisions are involved in these operations.

Sinclair Oil and Koppers Co. are jointly building a petrochemical plant at Houston, Texas to produce styrene monomer, with operation scheduled in mid-1961 at a rate of 70 million lb. a year.

Cosden will expand its 20-million-lb. plant at Big Spring, Texas to 60 million lb., with completion foreseen by late 1960.

Foster Grant is expected to expand to 150 million pounds from the present 110 and Odessa will increase to 60 million from the present 40. All the companies mentioned, except Odessa, are expected to increase polymer capacity. Only Union Carbide and Shell Chemical, of the monomer producers, are unheard from up to now.

And sure enough, independent polymer producers are springing up all over. Seventeen are now in business or expect to be soon.

W. R. Grace ties in with Cosden. Grace has received and accepted at $25 per share tenders of 1,580,000 shares of Cosden Petroleum, representing slightly over 51% of the outstanding shares. In addition to production of styrene monomer and polymer mentioned above, Cosden has been developing benzene, xylene, toluene, polybutene, ortho-xylene, and paraxylene.

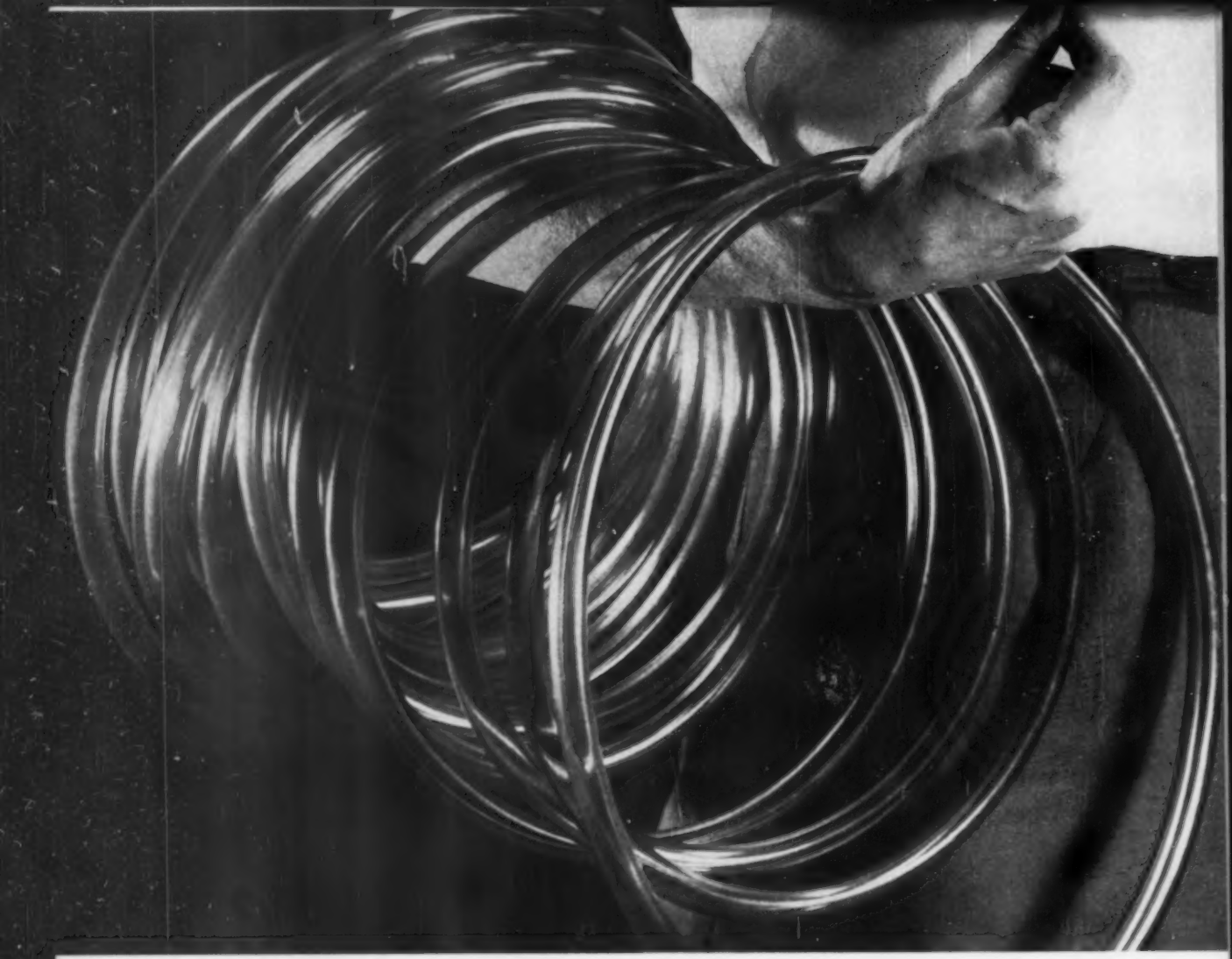
Cosden has also announced that it will increase production of ortho-xylene to more than 70 million lb. a year, with plans for doubling. Ortho-xylene is coming into increasing demand because it can be used to replace naphthalene in the production of phthalic anhydride both of which were in short supply in 1959.

The acquired control of Cosden adds several strings to Grace's bow in the plastics and chemicals industry. The company will now have polystyrene as well as polyethylene to sell its customers, and the ortho-xylene ties in with Hatco, a Grace subsidiary that produces plasticizers.

New stabilizers for unplasticized vinyl. Problems in stabilizing unplasticized vinyl with a non-toxic stabilizer have been difficult and troublesome for a long time. One of the reasons is that a satisfactory non-toxic stabilizer which will withstand the heat required to work unplasticized vinyl in an extruder is hard to find. This is one of the reasons why unplasticized PVC thin film is seldom used in the food packaging industry.

Argus Chemical has moved to help correct this situation by introducing three new non-toxic stabilizers especially developed for use with rigid vinyl. They have been recognized as safe for use by FDA, according to Argus. They are being evaluated for use in pipe for potable water, in rigid calendered sheet, and offer interesting possibilities for use in extruded thin unplasticized film for packaging, where their heat resistance gives promise of more satisfactory stabilization than non-toxic stabilizers currently available, according to Argus. Prices and further details are given on page 208.

Vinyl for pipe. A new "quadmer," P-1004, designed specifically for the rigid pipe, conduit and fittings industries, is now being marketed by J. P. Frank (To page 41)



VYGEN 120 takes the kink out of garden hose production

VYGEN®

VYGEN 85 — Recommended for calendering, extrusion and molding operations where processing at low temperatures is desired.

VYGEN 105 — For light-embossed sheeting and for molded items and extrusions requiring high gloss finish.

VYGEN 110 — General purpose resin for calendered film, sheeting and coated fabrics . . . molding and extruding. Excellent heat and light stability.

Creating Progress Through Chemistry

Chemical Division GENERAL
THE GENERAL TIRE & RUBBER CO.

In the manufacture of quality garden hose high reject rates caused by jelled particles can be a problem. You can lick this problem with VYGEN 120 . . . the quality PVC resin that is especially suited for dry blend extrusion. Quality VYGEN 120 is one of a family of specialized resins developed and manufactured to meet the requirement of the processor and the demands of the end product. If you have extruding, molding or calendering problems . . . let us show you how the VYGEN family of quality resins can solve them for you . . . a letter from you today will start the ball rolling.

THE GENERAL TIRE & RUBBER COMPANY
Chemical Division · Akron, Ohio

Chemicals for the rubber, paint, paper, textile, plastics and other industries: **GENTRO SBR** *rubber* **GENTRO-JET** *black masterbatch* • **GEN-FLO** *styrene-butadiene latices* • **GEN-TAC** *vinyl pyridine latex* • **GENTHANE** *polyurethane elastomer* • **ACRI-FLO** *styrene-acrylic latices* • **VYGEN PVC** *resins and compounds* • **KURE-BLEND** TMTD *masterbatch* • **KO-BLEND** *insoluble sulfur masterbatch*

THE PLASTISCOPE

(*Continued from page 39*)

Chemical Co. Inc., New York, N. Y. It is said to be chiefly vinyl-chloride-copolymerized with small amounts of three other vinyl monomers to give good processing and finish characteristics.

The intermolecular lubricity, imparted by the special co-monomers is said to permit up to 30% faster extrusion and molding operation. Independent laboratory tests are asserted to show that the processing improvements have been gained without sacrifice of other characteristics common to rigid vinyl. Since the company had previously announced a copolymer with vinyl stearate for phonograph records it might be assumed that this monomer, frequently mentioned as a material useful for inner plasticization to impart ease of processing, is one of the monomers involved.

Finely divided polyethylene. U.S.I. now has available powdered polyethylene, trademarked Microthene. Powdered PE is not new since it was made available by other companies several years ago for flame spraying and has been supplied by Heisler Corp., Wilmington, Del. for use in drum linings and drums over a number of years. Spencer's plans for powdered resin are outlined on page 86 of this issue.

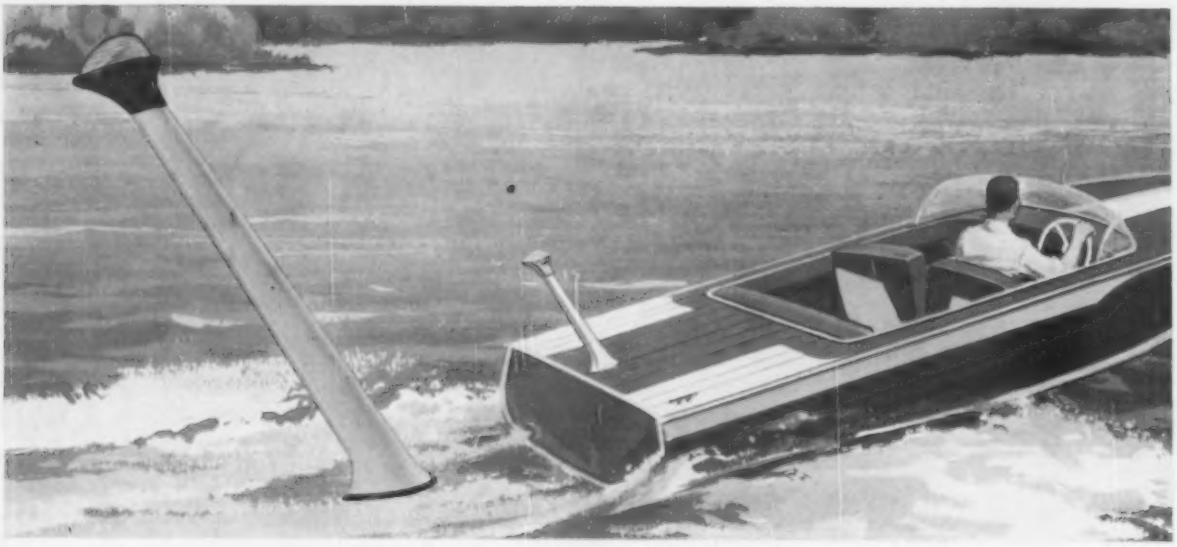
However, the U.S.I. powder is expected to broaden the base for this material and is suggested for such uses as textile, metal, paper and wire coatings in addition to the previously mentioned items. A synthetic glassine has been made from this material in Europe. Wire and glass coatings and additives in wax or polishes is another suggestion.

Two types are available. One, solution-processed is small mesh in the 200 range. Mechanical grinding produces from 50 to 200 mesh material. Both will be available in densities of 0.916—M.I. 22 and 0.924—M.I. 5. Introductory prices will be 65¢/lb. for the fine grade and 40¢ for coarse. It can be applied in powder form or in water or alcohol dispersions. The fluidized-bed technique can be used for coating metal items including wire.

Rexall on the move again. Possible expansion of Rexall's plastics operations into an integrated organization that may some day rival or exceed most other groups in the industry in variety of products and volume production now seems apparent. One or more units now produce finished items in vinyl, polystyrene, and polyethylene, and rubber and then there is a styrene polymerization plant with a likelihood that a polyolefin plant will soon be planned.

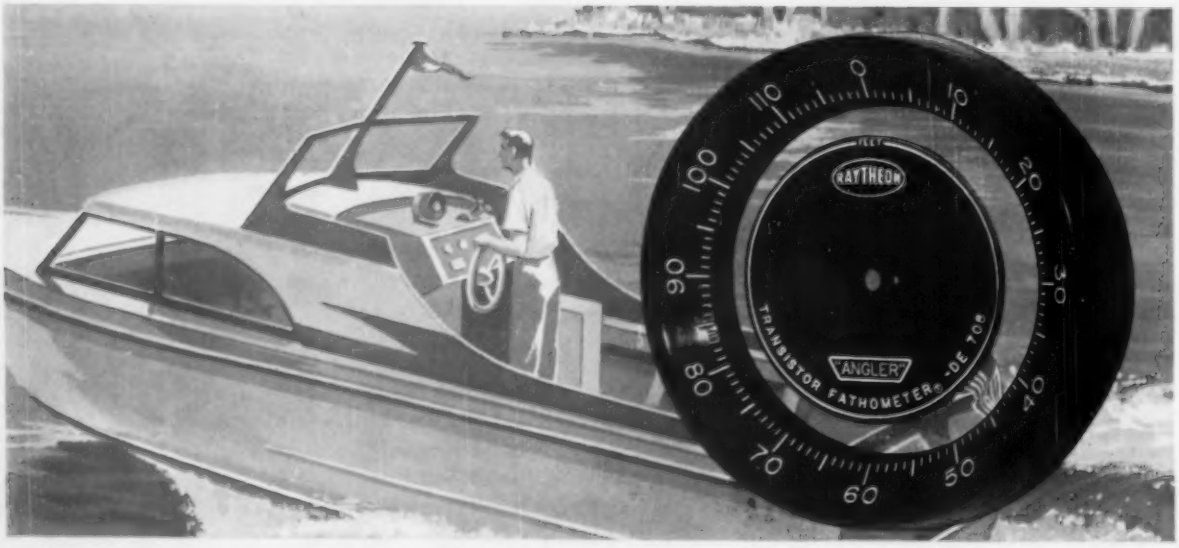
The recent appointment of Ralph M. Knight as president of Rexall's Chemical Div. gives point to this view. Mr. Knight, formerly vice-president of National Distillers & Chemical Corp. (U.S.I.), had a large part in building and operating that company's PE plant. Before that he served Du Pont, where he was involved in the process design of its first PE facility. His vice-president will be John R. Provo, formerly division superintendent of PE for Du Pont. It can be assumed that one of Mr. Knight's first duties will be to build and operate a polyolefin plant.

Rexall already owns three plants that must consume between 30 and 40 million lb. of polyethylene a year between them, namely Tupper, Imco, and Chippewa—and all are expanding. Tupper is reportedly now in the film business as well as molding, and Chippewa is building an- (To page 43)



Handsome and Hardworking

Plexiglas ... Implex



Look how PLEXIGLAS® acrylic plastic and IMPLEX®, the high impact acrylic, work together! PLEXIGLAS for the stern light lens shown above and the dial section of the depth finder, below. IMPLEX for the staff of the stern light and the housing of the depth finder.

One or both of these two Rohm & Haas molding materials —strong, handsome PLEXIGLAS and tough, colorful IMPLEX—may be just what you need to give *your* products added usefulness and sales appeal. We will be glad to send you detailed information, and provide design assistance to help you take full advantage of the outstanding properties of PLEXIGLAS and IMPLEX.

Chemicals for Industry

ROHM & HAAS COMPANY

WASHINGTON SQUARE, PHILADELPHIA 5, PA.

In Canada: *Rohm & Haas Company of Canada, Ltd., West Hill, Ontario*

THE PLASTISCOPE

(*Continued from page 41*)

other film plant near Los Angeles. A recent purchase by Rexall was Package Containers in Salinas, Calif., a flexible package manufacturer that grew out of the Growers Container Co., a California produce growers cooperative.

Rexall also owns Kraloy, a vinyl pipe plant, and Chemtrol, a pipe fittings plant, both in Southern California. In addition the company owns Seamco in New England and Granada in Calif., both polystyrene producers.

Film plants on West Coast. The possibility that Rexall might build a resin plant on the Pacific Coast, since headquarters are in Los Angeles and raw materials are available, calls attention to a concentration of polyolefin operations in that area that is growing by the month. Union Carbide has a polyethylene plant in Torrance, and Dow is building a polypropylene plant at that same location. Film processors on the coast are Extruders (Dow owned), moving to San Francisco area from Los Angeles; Davidson in Seattle; Pacific Extruders, Seattle; Durathene, Visking, Ralston (Tech Tape), and Interstate in the Southern Calif. area; Bemis Bag and Kordite in the San Francisco area. Chase Bag is reported as a possibility and there are doubtless others considering the move.

Another entrant into pipe field. Johns-Manville has purchased Franklin Plastics Inc., Franklin, Pa., manufacturer of plastics pipe. Dixon Downey, owner of Franklin, will continue operation of Gulf Stream Plastics Inc., Hialeah, Fla., for the manufacture of fittings and custom molded components. Franklin has been operating for six years as a producer of polyethylene, styrene, and ABS pipe, with a rated production capacity in excess of $4 million.

More melamine. Somewhere around 60 million lb. of melamine molding powder and 30 million lb. of laminating resin were consumed by the plastics industry in 1959. Early in the 50's these figures were respectively around 20 and 10. Their growth has been due largely to dinnerware and decorative laminates. It is not surprising to note that producers are expanding their capacity. Allied Chemical stated that it would double capacity of melamine and urea production with full-scale production of 45 million pounds.

American Cyanamid announced plans for new facilities to produce melamine crystal last July with 10-million-lb. capacity. Reichhold announced a 20-million-lb. plant designed for expansion to 50 million lb. about the same time. The crystal plant will come in during late 1960. It is expected that melamine molding and laminating materials will be available in 1961.

Fragrant polyethylene. U.S.I. is now marketing a resin with fragrance that can be used for film to give such aromas as "clean linen," candy and cookie aroma, orange, pine, even onion and various others. It is sold in a resin concentrate, called Poly-Scent, that can be dry blended in the hopper with conventional PE. Between ¼ and 2% of concentrate is used. It sells for $1.50 to $5/lb. Scented film is now being produced by Texas Plastics Inc., Elsa, Texas.

For additional and more detailed news see Section 2, starting on p. 208

LETTERS TO MODERN PLASTICS

Where readers may voice their opinions on any phase of the plastics industries. The editors take no responsibility for opinions expressed.

Erroneous references

Sir: In your Dec. 1959 issue of "The Plastiscope" (p. 45) section of MODERN PLASTICS appeared several erroneous references to The Sun Rubber Co., its patent situation, and its business status in the period since June 1958.

Your first statement referred to Sun Rubber and (we quote) "patent situation in slush molding." The patents referred to are our Molitor Patent No. 2,629,134 "Method of Manufacturing Articles from Vinyl Resins" and Martin-Rekettye Patent No. 2,629,131 "Apparatus for the Manufacture of Hollow Cast Articles." These cover the Process and Machinery for manufacturing rotationally cast hollow articles from vinyl plastisols respectively *and are not related in any way to the process of slush molding.*

The second erroneous statement reported (we quote) "Sun halted operations and went into voluntary bankruptcy when it lost a suit for infringement of its patents." This statement in both its parts is again entirely false and misleading. *Sun did not go into voluntary bankruptcy.* Because of operating losses incurred in developing rotational vinyl casting machines, transition from rubber to vinyl products manufacturing, changes in physical plant layout and process procedures, and volume loss in rubber goods manufacturing, Sun found itself with a depleted working capital, unable to continue 1958 operations without refinancing. Our Company, therefore, applied for relief under Chapter XI of the Chandler Act, which was granted, allowing us to remain in possession of our assets, under the jurisdiction of the Court but not in receivership, while we arranged our financial affairs for the benefit of all creditors and stockholders. *Since November 1, 1959, refinancing has been completed, assuring all creditors payment in full and stockholder interests have been protected.*

The second part of your statement (referred to in the first sentence of our paragraph above) said (we quote) "it (Sun) lost a suit for infringement of its patents." *Sun did not lose its patent suits.* The Honorable John Paul Jones, Judge of the United States District Court for the Northern District of Ohio, Eastern Division, ruled in January, 1958 (suit filed in July, 1954) that our patents (named above) were valid and had been infringed by both defendants, The National Latex Products Co. of Ashland, Ohio, and The Akron Presform Mold Co. of Cuyahoga Falls, Ohio. The defendants appealed to the United States Sixth Circuit Court of Appeals, sitting in Cincinnati, Ohio, on Feb. 16, 1959 and on Oct. 28, 1959, this Court held that Sun's Molitor Patent No. 2,629,134 was valid and had been infringed by both defendants and that our Martin-Rekettye Patent No. 2,629,131 was valid but it was not infringed.

T. W. Smith Jr., Pres.
The Sun Rubber Co.
Barberton, Ohio

Let's educate the public

Sir: In reference to your editorial in the January issue of MODERN PLASTICS, may I point up the following problems that we processors are faced with regarding public opinion?

The keynote of any campaign to bring to the public's mind the vast wonderful world of plastics is one word, *quality.*

The too common association of cheapness with plastics is costing this industry many millions of dollars in the sales of established products that are in competition with metals, woods, glass, textiles, rubber goods, etc., as well as hampering the development of hundreds of new products. Let's face it, we cannot always compete with the above industries on a price basis, and, even where we do, let's stand on the merits of quality first and foremost in our advertising.

The competition is underlining all their messages with the reference that nothing takes the place of steel, or cotton, or foam rubber, etc. Let's get this brash young industry together and show the customer (the public) through a solid repetitive advertising campaign just where and how plastics not only takes the place of these competitors but also improves the quality of the products. Education is the only answer. Advertising from the industry as a whole is the only method.

Let's tell the public what plastics really mean. Tell the housewife that her expensive draperies and hose are plastic as well as the inexpensive disposable rain hoods. Tell the man of the house that the satellite circling the sun is made up in great part by miracle plastics as well as the toy tank his son is playing with. Tell them they are sitting on plastic, walking on it, wearing it, sleeping on it, playing with it, learning with it, living in it, and it all adds up to a richer, wider more wonderful world for them.

Nothing can take the place of plastics!

Don Narsh,
Asst. Mgr.
Chicago Plastic Products Co. Inc.
Chicago, Ill.

We couldn't agree more. A typical case in point is the new Thermos bottle described on p. 97 of this issue. However, plastics cannot only do a better job, they can often do it at a lower cost. One of the most outstanding examples of this combination at work is the new high-density polyethylene seat side panel introduced on the 1960 Fords, on which full details are presented in a feature starting on p. 88.—Ed.

Macy's does it again

Sir: I though your readers might be interested in learning that Macy's has now installed a fully automatic blow-molding machine in its Housewares Dept., which is producing a 2-qt. refrigerator container from Grex high-density polyethylene. This product is sold right at the machine as fast as it is produced.

The store is sure keeping the public up-to-date on plastics.

H. V. Chanko, Pres.
Kautex-U. S. Sales Co. Inc.
Flushing, N. Y.

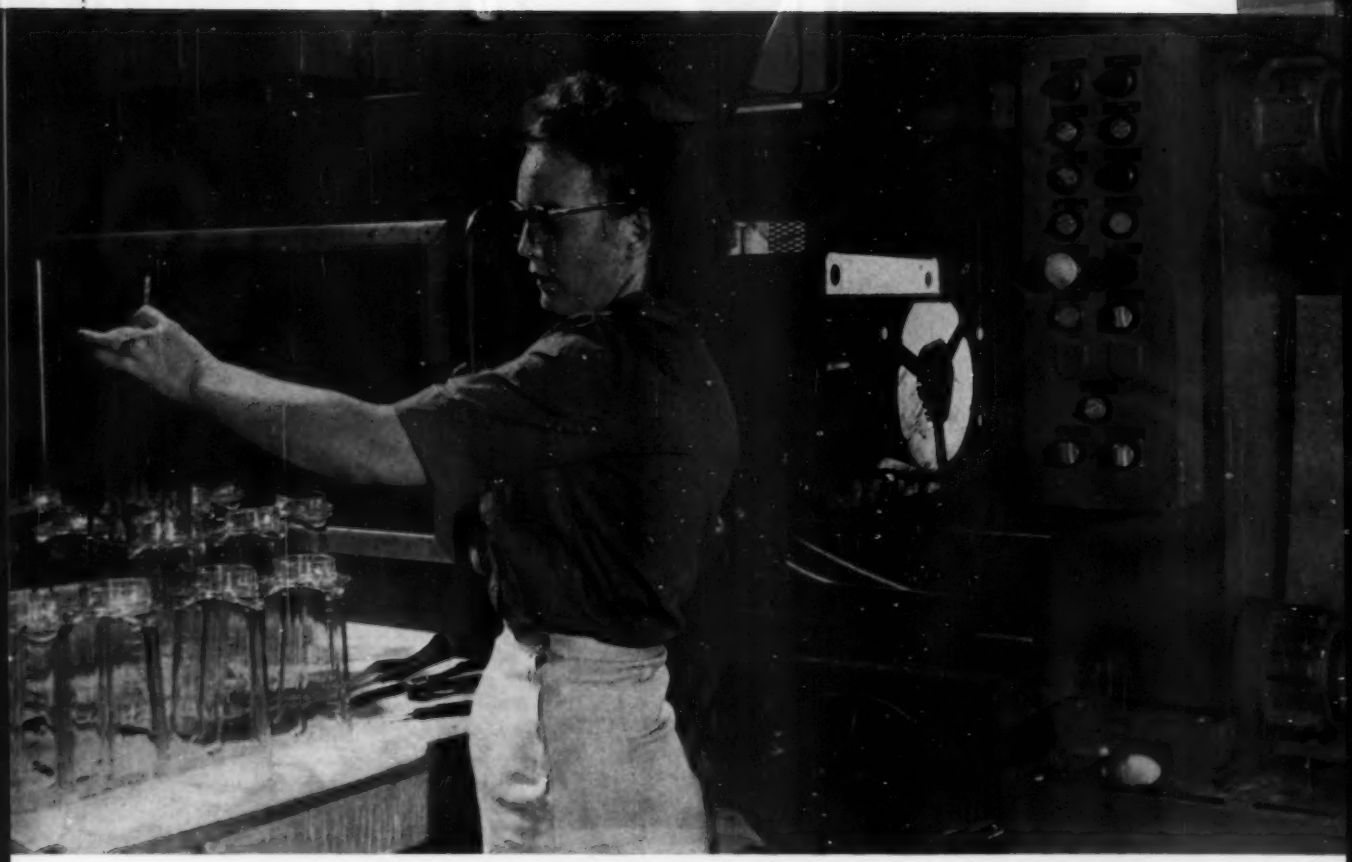
The price wasn't right

Sir: A copy of the January 1960 issue of MODERN PLASTICS came across my desk today.

I believe I discovered an error in your cost table on page 106. The last item of .001-in. aluminum foil is listed as $.007 per 1000 sq. inches. Should this not be $.07?

E. A. Yermakoff,
Project Leader,
Packaging Laboratory
General Foods Corp.
Research Center
Tarrytown, N. Y.

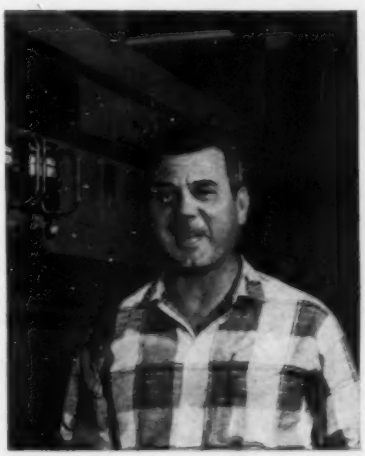
Almost. This was the printer's devil's work. The correct figure should be $0.067.—Ed.



KUSAN, INC., molds close tolerance acrylonitrile juicer bowls on their NATCO 300.

"Maintenance on our Natcos has been next to nothing"

...according to R. E. Brackett, Plant Manager of KUSAN



And . . . "What's more our operators like the Natco because it's simple to control, molds are easily changed and . . . it doesn't vibrate all over the place."

Kusan, Inc., Henderson, Ky. are molders who expect the most of their equipment. With the many exclusive features and versatility of NATCO they are getting just what they want.

NATCO'S shockless hydraulics eliminate damaging vibrations; simple controls provide high speed trouble free molding and NATCO'S high melt capacity assures fast cycles. These features plus many more have proven that NATCO is the "Molders Molding Machine."

Write for more information on the NATCO 12 to 80 ounce capacity injection molding machines. Ask for Catalog 2001.

NATCO

THE MOLDER'S MOLDING MACHINE

NATIONAL AUTOMATIC TOOL COMPANY, INC.

PLASTICS MACHINERY DIVISION

RICHMOND, INDIANA, U. S. A.

NEW MACHINERY-EQUIPMENT

Specifications, claims made, and prices appearing in these pages are those of the manufacturers or sellers of the machinery and equipment described, or their agents.*

Dinnerware press

Especially designed for molding melamine dinnerware, compression press is completely self-contained and is equipped with a remote electrical cabinet. The hydraulic and electrical circuits are specifically designed for double cycle with

HPM compression press is downward acting, eliminates need for pits and allows free access to work area.

selector switch for decal work; degassing cycle, which is automatic for single or double cycle; and automatic timer cycle. Optional extras include grids and parallels, daylight spacers, steam plates with insulation, scissor linkage for floating platen (dual slide type), and auxiliary power unit for core pulls. The press has low head room, with power unit, oil tank and heat exchanger mounted overhead. It is built in three standard sizes—300-, 400-, and 500-ton capacities. *The Hydraulic Press Mfg. Co., Div. of Koehring Co., Mount Gilead, Ohio.*

Radiation thermometer

In the plastics industry situations sometimes arise where the use of a thermometer which requires contact with the temperature source is inconvenient or not practical. A few examples are measuring the temperature of a moving web in extrusion and calendering work, or the temperatures on plastic nose cones in ablation tests. The Thermodot Model TD-3 radiation thermometer measures the temperature of a remote object without physical contact. Operation is based on the fact that an object emits thermal radiation as a function of its temperature. An infra-red transmitting lens is used to focus this radiation onto a sensitive infra-red detector. The detector generates a signal voltage accurately proportional to the radiation intensity. This is amplified and automatically, continuously, and immediately indicated on a scale calibrated directly in temperature. Since the operation is completely remote, the viewed surface cannot be contaminated, damaged or influenced in any way. Built-in standardization is provided. A hermetically sealed sensing element eliminates external contamination and ambient temperature variations from 20 to 120° F. have no effect on the operation. Temperature ranges from 180 to 2000° F. are available. *Radiation Electronics Co., 5600 W. Jarvis Ave., Chicago 48, Ill.*

Ribbon blender

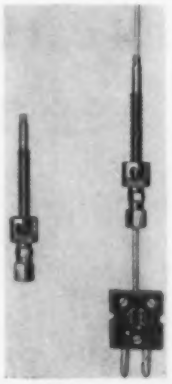
For use in the production of vinyl dry blends, a line of blenders, with capacities of 20 to 200 cu. ft., are being made with mild steel, stainless steel, or vinyl lined tubs. The units are available with internal spray lines for liquid addition and bolted gasketed top covers with hinged panels for loading and cleaning. They are equipped with a bottom center discharge port with either a drop or paddle gate. Blenders can be purchased with or without jacketing for steam or water. *Munson Mill Machinery Co., Utica, N. Y.*

Custom laboratory presses

Presses are designed for laboratory conditions where pressure, temperature, and work results must be consistently reproduced each and every time. Laminating or molding tolerances can be held to ±0.001 in. with a deflection-free slabside frame and a platen guiding arrangement that produces true parallel movement of platens. Each press is custom designed and engineered, in any size or capacity, to suit individual applications and then economically built from standard component parts. Electric or steam platens can be equipped with special controllers to maintain precise temperatures in any desired range up to 1000° F. A new self-contained pumping unit automatically maintains any preset hydraulic pressure, during entire cure cycle, without personal attention. *Atlas Hydraulics Div., Delaware Valley Mfg. Co. Inc., 3576 Ruth St., Philadelphia 34, Pa.*

Thermocouple adapter

For use on plastic extruders, thermocouple adapter converts a ⅛- or 1/16-in. Ceramo (or other metal-sheathed tubular type thermocouple) to a spring-loaded type with an immersion length adjustable from 1 in. minimum. It solves problems caused by measuring temperatures at varying immersion depths in a system where a fixed immersion thermocouple would be impractical. The adapter is made of a stainless steel sheath and cap, Inconel X or stainless steel spring, a nickel-plated brass compression fitting and a brass or nylon ferrule. The brass ferrule provides a permanent immersion setting while the nylon ferrule allows for adjustment of the immersion length. Spring-loaded, the thermocouple compensates for expansion, contraction, and vibration by keeping the junction of the thermocouple in close contact with the surface being measured. *Thermo Electric Co. Inc., Saddle Brook, N. J.*



Small granulator

Designed to meet the needs of users of small molding machines, this equipment can handle sprues up to ¼ in. diameter. The loading chute aperture is 3¼ in. by 2½ inches. All normal types of ther- **(To page 48)**

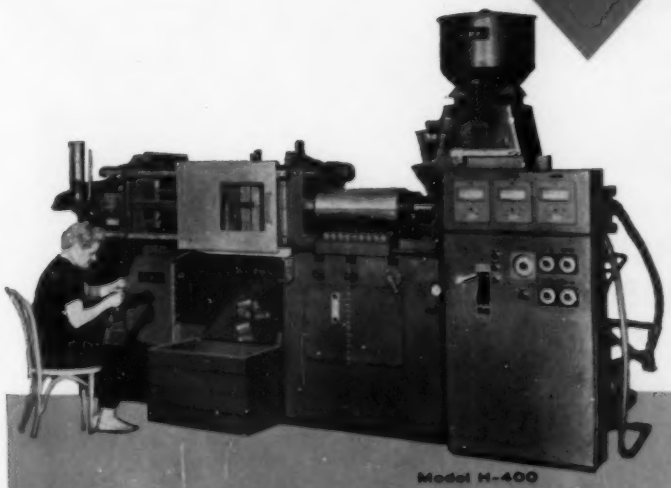
* Prices are deemed to be F.O.B. sellers' plants (unless otherwise stated), are for "standard" models, and are subject to change without notice. The publishers and editors of MODERN PLASTICS do not warrant and do not assume any responsibility whatsoever for the correctness of the same, or otherwise.

"COMPLETE AUTOMATION"

Prominent toy manufacturer operates their fully automatic Van Dorn 3 oz. presses 24 hours per day, 6 days per week. They also report their Van Dorn presses substantially reduce cycle time, are economical, versatile, and require minimum maintenance.

Model H-300

GAIN 3 WAYS with VAN DORN Presses



Model H-400

Model H-260

"PACKAGE SERVICE"

The user of this Van Dorn 4-6 oz. press had a well conceived idea for a plastic part, but no molding experience. So they had Van Dorn engineers help them procure a well designed mold from a competent moldmaker; then checked the operation of the finished mold on a Van Dorn factory demonstration unit. This free Van Dorn "Package Service" insures satisfaction, helps produce profits.

"25% LESS CYCLE TIME"

This is the report of a progressive custom molder about his Van Dorn 2½ oz. presses. He also says that they "give fast set-ups, and less waste in purging from one material to another. Van Dorns are extremely fast, versatile and economical."

Write for illustrated Specification Bulletins on these Van Dorn Plastic Presses.

Van Dorn

THE VAN DORN IRON WORKS CO. • 2868 EAST 79TH STREET • CLEVELAND 4, OHIO

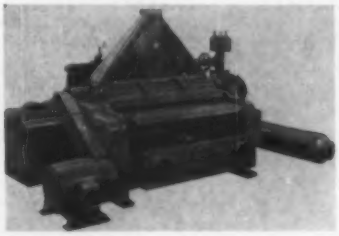
NEW MACHINERY

(From page 46)

moplastics can be handled. Size of granulation can be varied by interchangeable screens. The unit is supplied for bench mounting but can be adapted to stands or trolleys. Two minutes is the average time taken between changes of materials. When the cover is loosened the power is automatically cut off so that the rotor comes to rest before the cover is fully open. The special loading trap minimizes the throw-back of particles of plastic during loading. *S. R. Seymour & Co. Ltd., Essex, England.* Agents in U. S. A.—*Stein Equipment Co., 107 Eighth St., Brooklyn 15, N. Y.* (British made throughout)

Surface planer

For use in reclaiming scrap material from laminates and other plastic surfacing applications, planers have up to a 72 in. working width. Equipped with a patented vacuum bed, even thin material 30 mils or less in total thickness can be surfaced provided there is enough rigidity in the sheet to permit proper feeding. The vacuum action helps hold the stock flat and prevents it from lifting as it passes under the cutting head yielding commerical finishes to precise tolerances. The planing head is equipped with six carbide knives which are fed by four driven rolls operated by a variable feed control. Grinding equipment for sharpening the knives is an integral part of the machine. Special planers are also available for other jobs. *Buss Machine Works Inc., Holland, Mich.*



BUSS MACHINE surface planer can accommodate sheets 72 in. wide.

Blow molder

Holoform semi-automatic two-station blow molding machine produces items up to 12 in. in diameter and 27 in. long. The machines use vacuum on the mold to assist in large-part production, reducing the necessity for large high-pressure clamping systems. The complete parcel includes twin-head die set, vacuum-blowing machine, vacuum pump system, hydraulic pressure system, vacuum platens, and fully pneumatically timed control panel. The machine is designed to be used with any commercial extruder. Optional features include automatic removal of the blown parts on continuous conveyor belt system, enabling subsequent operations to be performed with the product placed in a fixed position. *Tayklo Holdings Limited, P. O. Box 276, Galt, Ontario, Canada.*

Environmental wire testing

Testing chambers, especially designed for testing plastic coated wire and insulation breakdown in accordance with military specifications, are made so that a mandrel can be installed in the upper part. One end of wire to be tested is suspended from the mandrel, with the other end hanging free. A specified weight is attached to the free end to exert a force on the wire. Using an external control, the wire is wound on the mandrel without disturbing the test temperature. After winding, the sample is examined for surface **(To page 50)**

PRODEX
HENSCHEL
MIXERS
DIFFICULT MIXING AND DISPERSION PROBLEMS ARE SOLVED WITH THE PRODEX HENSCHEL MIXER
The PRODEX-HENSCHEL MIXER, successfully used in many installations here and abroad, performs intensive dryblending and thorough dispersion of colors, pigments, fillers, stabilizers and/or plasticizers with plastics powders or granules.
It permits, if desired, the mechanical (frictional) heat-up of plastics powders faster and more uniformly than by conduction or radiation.
The unique principle of fluidizing dry powders so that they can be mixed like liquids, plus controlled shearing action, result in mixing quality and speeds heretofore not obtained.
ARRANGE FOR A DEMONSTRATION
Investigate how it can increase the efficiency of your process.
Write for illustrated bulletin M-1.
PRODEX CORPORATION • FORDS, NEW JERSEY • Phone: HILLCREST 2-2800

NONPOROUS extrusions from POWDER BLENDS or granules ...a PRODEX SPECIALTY

Complete PRODEX EXTRUSION SYSTEMS are available for sheet, roll cast film, pipe, wire and cable, compounding. PRODEX EXTRUDERS are available in sizes ranging from 1¾" through 8" with L/D ratios of 20: 1, 24: 1 and longer...with or without venting.

Write for illustrated bulletin E-6.

- The versatile PRODEX EXTRUDER can be used either as a conventional (single stage) extruder or as a two-stage extruder with a venting zone.
- When used as a two-stage extruder with venting zone, it completely removes moisture, air and volatiles from the polymer without predrying. The two-stage extruder also does an excellent job when extruding powder blend directly.
- Rigid and flexible PVC, hi-impact styrene, ABS polymers, cellulosics, nylons and polyolefins...all are extruded better and without predrying by the powerful PRODEX...and at production rates that make PRODEX EXTRUDERS the lowest-priced machines available because they produce more pounds per hour per invested dollar.
- See PRODEX EXTRUDERS perform with your material in our customer service laboratory. Write or phone for an appointment.

PRODEX CORPORATION

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PRODEX — in design and performance ALWAYS A YEAR AHEAD

(From page 48)

cracking and other flaws. The one-piece cabinet is 84 in. high, 20 in. wide, and 42 in. deep. The testing chamber itself measures 72 in. high and 12 by 12 inches. The chamber is lighted, has a frostproof window 6 in. wide by 12 in. high, and is available with or without an air circulator. The unit operates on 230 v. and has a temperature adjustment from —10 to —80°F. Thermal capacity is 200 BTu/hr. at —70°F. Other capacities available. *Cincinnati Sub Zero Products, 3932 Reading Rd., Cincinnati 29, Ohio.*

Foam tester

Accurate compression modulus readings on urethane foams can be obtained with the Wohler Foam Tester. Based on a simple dead weight principle, this instrument uses the industry-standard 50 sq. in. compression foot and specially designed disk weights. No calculations are required on standard tests since cushion height and deflection are indicated automatically on direct reading scales. Foam slabs from 1 ft. square up may be tested. The standard model has a compression range of 42.5 lb. which may be increased to 62.5 lb. by adding extra weights. Normal thickness range is 2 to 6 inches. Price $189.50, F.O.B. Akron, Ohio. *The Browning Instrument Co., P. O. Box 152, Bath, Ohio.*

Automatic feed attachment

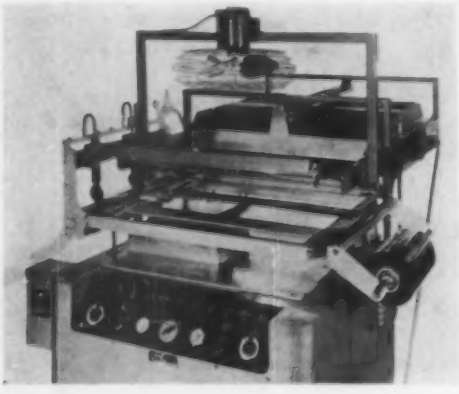
Designed for the Comet Meteor thermoforming machine, attachment completely automates the machine releasing an operator for other duties. The basic unit provides for automatic loading and unloading of the clamp frame and feeding the roll stock film automatically. After forming the web is automatically slit into strips, separating blisters or skin packages. Price of the attachment only for the Meteor 3036 is $1,250. *Comet Industries, Franklin Park., Ill.*

Winding, cutting control

Atcotrol Revolution Counter can be used to automatically control winding and cutting operations in extrusion processes producing wire, rods, pipe and sheet. The device counts shaft revolutions at rates up to 1000 r.p.m. and is available in eleven dial ranges from 0-12 to 240,000 revolutions. A knob-operated setting hand determines the number of input revolutions required before control action occurs. Clutch action automatically resets the instrument and the knob setting need not be reset until a new control point is required. By proper adaption the device can be used to cut extrusion to length, to cut off spools of wire, count footage and control any operation that is related to the length of the extrusion. *Automatic Timing & Controls Inc., King of Prussia, Pa.*

Pyrometer

The Alnor 2300-B is specifically designed for such work as measuring injection mold temperatures. The instrument cover —40 to 200° F. in two overlapping ranges; one from —40 to 120° F. and the second from 50 to 200° F. Scale divisions are 1° F. and the instrument's accuracy is ±1 percent. A reference block and thermometer are provided for easy setting of ambient temperatures between 30 and 110° F. Price of the instrument without thermocouples and carrying case is $160 F.O.B. Chicago, Ill. Six thermocouples (surface, needle, etc.) and case are available at $35 each on exactly the same terms. *Illinois Testing Laboratories Inc., 420 North LaSalle St., Chicago 10, Ill.*



COMET METEOR automatic feed attachment is available on new Meteor machines or can be added to Meteor equipment now in use.

Mold patcher

The Dot Welder is a gun-type welding device which can be used to repair errors, scratches, cavities, and undercuts in plastic molding dies, often without removing the mold from the machine. The device fuses a metal pellet fed into the surface of the mold, filling in the defect. Fusion is produced by a short pulse of high-density electric current and does not damage the surrounding die surface nor does the die need to be preheated. After the defect is filled in, the welded patch may be filed or finish ground to the point where the repair is almost invisible. *Mid States Welder Mfg. Co., 6025 S. Ashland Ave., Chicago 36, Ill.*

Milling machine

Available in 14 models and 34 combinations, Bedmill is built only to specific requirements of the purchaser. For use in plastic mold work, it will perform as a production profiling machine, duplicator in three dimensions, or as a conventional milling machine. Table surface is 24 by 84 in. and has five T-slots of $\frac{13}{16}$ in. size. Longitudinal feed is 48 in., cross feed is 16 in., vertical ram movement is 24 in., transverse ram movement is 16 in., and the maximum cross range (saddle and ram) is 32 inches. Distance from cutter spindle to table top ranges from a minimum of 6½ in. to a maximum of 38 inches. The basic machine is available in many different combinations of speeds and feeds; electrically and/or hydraulically actuated to meet differing requirements. *The George Gorton Machine Co., Racine, Wis.*

Pipe printer

For continuous repeat printing of lettering or design on various diameters of plastic tubing, this printing machine is completely enclosed in a steel cabinet with the printing unit protected by a guard that permits only the necessary access for the making of die changes.

An enclosed ink fountain with adjustable feed, and a fine adjustment provides exactly the right amount of ink from a series of felt ink rolls for a light or heavy impression. A series of V rolls, adjustable from a knob on the work table, adjusts for the tube or rod diameter up to 2 inches. The printing head is driven by gear reduction motor controlled by switch on the back, at printing speed. Where a **(To page 52)**

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(From page 50)

variation of printing speeds for different tubes is needed, a vari-speed unit can be included. The machine is approximately 20 in. wide by 38 in. high, and 12 in. deep. Driving power is 110 to 220 v.a.c. *The Acromark Co., 5-15 Morrell St., Elizabeth, N. J.*

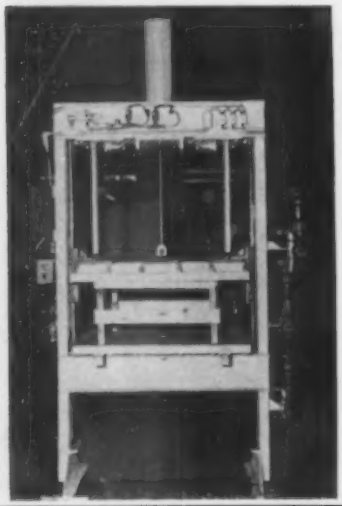
Thickness gage

Using Strontium 90 and Ruthenium 106 as sources of nuclear radiation, RCL Model 51001 will measure plastic film thicknesses up to 0.5 inch. Model RCL 51007, using the same sources, will measure ¼-in. to 20-mil coatings on sub-strata, such as paper, from one side only. Accuracy is better than ±1% on the film gage and ±2% on the coating gage. Both systems use the RCL Model 42000 control unit which has an ambient temperature range of 0 to 35° C. Response time is continuously variable from ¼ to 30 sec., and the sensitivity of the instrument is variable in 29 steps. *Radiation Counter Laboratories Inc., 5121 W. Grove Ave., Skokie, Ill.*

Foam press

Specifically designed for the molding of polystyrene foams from pre-expanded beads, Shur-Lock press uses no oil hydraulic system. Movement of the press platens and the locking of the mold in the closed position are entirely air actuated. The unit requires an air supply with a maximum pressure of 100 to 125 p.s.i. capable of delivering 5 cu. ft. at 80 p.s.i. Platens are 36 by 42 in.; other sizes are available. Distance between tie rods is 48 in. and the maximum opening between platens is 40 inches. Air cylinder stroke is 36 inches. Depending on the air pressure, opening time is 5 to 15 sec. and closing time is 7 to 17 seconds. Platens are held closed by means of an air operated positive mechanical locking device and can handle 5 to 50 tons of mold back pressure. Since the press does not operate against high hydraulic pressures, it is of lightweight construction and is considerably lower in cost than a conventional compression press. Press comes without automatic cycle controls but controls are available to suit customers requirements. Price without controls, about $3000. *Miller & Van Winkle Co., 155 Sherman Ave., Paterson 2, N. J.*

SHUR-LOCK polystyrene foam press uses rack and tooth to provide positive mechanical locking of the mold. Both the locking and platens are air operated.

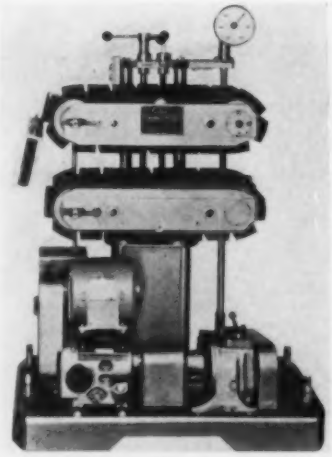


Thread cutter

The Fen-Thread-Miller will cut clean sharp threads on large plastic rods and tubes. Pitch and root diameters as well as the pitch angle are held to a tolerance of 0.001 inch. This applies to all materials: Teflon, reinforced plastics, nylon, methacrylate, cellulosics, and others. Thread-milling is completed with one pass, without overheating the material. Undercutting is eliminated since the device threads flush to a shoulder. Within 4 to 5 min., one person can set up the milling attachment on any 9- to 20-in. screw-cutting lathe. A wide range of cutters is available for cutting any 60°, Acme, square thread or even multiple threads, from ½ to 9 in. for internal threading, and from 1/32 to 9 in. for external threading. Cutting capacity ranges from 4 to 200 threads per inch. *Fen-Thread-Machine Co. Inc., 3107 N. Broad St., Philadelphia, Pa.*

Tube take-off

The Universal Take-offs provide a non-slip grip on extruded pipe or profiles over a wide contact area, between resilient pads mounted on two synchronized belts. Two models are available for handling extrusion diameters from 0 to 8 in. and 0 to 16 inches. Contact pressure of the pads is light to avoid distortion so the machine can be used with rigid or flexible or fragile, and thin-walled sections. It is supplied with casters for movement from one extruder line to another. Standard models are driven hydraulically at infinitely variable speeds. Various speed ranges between the limits of 0 and 500 ft./min. can be supplied. The unit is entirely self-contained having the motors, drives, and drive controls all mounted on the same base plate. Electronic drives are also available for more complex needs, including a switch-over from constant speed to constant tension operation. *Farris Universal Machine Corp., 622 Commercial Ave., Palisades Park, N. J.*



FARRIS UNIVERSAL Take-off machine is a compact 43 by 21 in. by 5½ ft. high.

Thermocouple wire

Called Insupack, this wire is a conventionally-insulated small-diameter, thermocouple wire sheathed in metal tubing. This wire is particularly effective in applications where mechanical loading or vibration would damage conventional thermocouple wire. It is supplied in all base metal calibrations (standard Instrument Society of America symbols—*T*, *J*, and *K*—and Chromel-Constantan) in single or duplex pairs. Standard wire diameters are ⅛-, 3/16- and ¼-in. with Fiberglas, Teflon, polyvinyl or Refrasil insulation. Copper, 304 stainless steel, and Inconel are standard sheaths—other sheath materials to special order. The metal sheath also enables the wire to be used at temperatures above the continuous temperature rating specified for identical insulations without sheaths. The wire can be supplied in lengths up to 50 feet—standard 25-ft. lengths in 1-ft. increments. *Pyrometer Company of America Inc., Penndel, Pa.*

Correction

"New Machinery-Equipment" (MPI, Feb. 1960, p. 48): Dobar Pre-expander will produce foam with densities between 0.8 lb./cu. ft. and any higher value desired.—**End**

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WORLD-WIDE PLASTICS DIGEST

Abstracts from the world's literature relative to plastics. For complete articles, send requests direct to publishers. List of addresses is at end of this section.

General

Urethane fiber—winner in the stretch? Chem. Week *85*, 73-74 (Nov. 14, 1959). The properties and production possibilities for elastic urethane polymer fibers, "Spandex" fibers, are discussed.

Propylene. Chem. Week *85*, 53-60, 65-70 (Nov. 14, 1959). The present and future markets for propylene are surveyed.

New route to flame-resistant polymers. W. A. Skinner, E. Bishop, D. Tieszen, and J. D. Johnston. Ind. Eng. Chem. *51*, 1359-60 (Nov. 1959). The synthesis of flame-resistant polymers from 3,3,3-trichloro-1-propene is described.

Acrylates and methacrylates. M. Salkind, E. H. Riddle, and R. W. Keefer. Ind. Eng. Chem. *51*, 1232-38 (Oct.); 1328-34 (Nov. 1959). Synthesis of intermediates for the production of acrylate and methacrylate monomers from natural gas and the air, the manufacture of the esters, and markets for the materials are discussed.

Materials

Some recent developments in stabilized dough molding compounds. C. P. Vale and J. Newton. Plastics (London) *24*, 361-65 (Oct. 1959). Stabilized dough molding, or premix, compounds have been developed for molders who do not wish to make their own mixes. The various ingredients used and the preparation of general-purpose, glass-filled molding compounds, and of self-extinguishing and sisal-filled compounds are described. Processing techniques, physical and chemical properties of these materials, as well as their applications and future developments are discussed.

Cast polyethylene film. D. Lewis and A. Zimmerman. Modern Packaging *33*, 153-57 (Oct. 1959). The properties of cast, blown, and water-quenched polyethylene films are compared. In general, the cast films have superior optical properties in freedom from haze, in gloss, and in transparency. Physical properties are usually better than those of quenched films but less than blown films. The primary use of cast films is in the package overwrapping field. However, other uses are expected since the casting method has the advantage of higher potential output over the conventional techniques.

TCEP fire retardant plasticizer. J. R. M. Johnston. Plastics (London) *24*, 459-60 (Nov. 1959). Trichloroethylphosphate (TCEP) is both a versatile plasticizer and an excellent fire retardant. Originally used primarily as a plasticizer for cellulosics, this compound has been evaluated as a fire retardant in a variety of other plastics. Among those in which increased flame resistance, and in some cases self-extinguishing properties, are obtained are cellulose nitrate, ethyl cellulose, polyvinyl chloride, polyesters, polyurethanes, polyvinyl acetate, and phenolics.

Impact resistant PVC granulates. G. Wick and H. König. Kunststoffe *49*, 506-12 (Oct. 1959). In addition to plasticized polyvinyl chloride, unplasticized grades have in recent years grown in importance. Their use has been limited on account of poor notched impact strength. The products described in this article are based on modification with an elastomer which was chosen because it imparts the desired properties without being appreciably affected by aging.

Molding and fabricating

Extrusion of unplasticized PVC film. A. E. Parker, Brit. Plastics *32*, 456-59 (Oct. 1959). Unplasticized polyvinyl chloride film has excellent resistance to acids, alkalies, oils, greases, and many organic solvents, and is comparable in cost to other film-forming plastics. Certain difficulties arise, however, in blow molding this material. Screen packs and breaker plates must be removed from the extruder and modified mandrels used to prevent dead spots and resin degradation. In order to obtain maximum clarity, heat stability, low odor retention, and good extrusion characteristics, a barium-cadmium-epoxide stabilizer and stearic acid lubricant were used in the polyvinyl chloride formulation.

Errors in coloring of injection molding compounds. K. Heinle and D. Hayer. Kunststoffe *49*, 576-82 (Oct. 1959). The causes and prevention of processing faults likely to occur in the coloring of injection molding compounds are exhaustively discussed. The following faults are included in the discussion: rough surface, silver streaks, local concentrations of color, fish eyes, differences in shade, and blooming.

Application of pressure cast beryllium copper in plastic molds. M. A. Nicholls, and W. F. Randall. Plastics (London) *24*, 328-30 (Sept. 1959). Beryllium-copper alloys possess certain physical and chemical properties that make them unique materials for use in molds. Mold castings are made by a pressure casting technique. Molten alloy is poured over a steel hob and cooled under pressure. The resultant molds are precise in detail, bright, and void of scale. Methods of casting the alloys, and some advantages of their use in plastics molding are described.

Applications

Low-pressure polyethylene drinking-water pipes. K. Richard, E. Gaube, and G. Diedrich. Kunststoffe *49*, 516-25 (Oct. 1959). Plastics pipes have to withstand more severe conditions than other plastics products. Often their mechanical strength and working life must exceed those of normal plastics products. The phenomenon of cold flow in thermoplastics as well as the influence this has on mechanical properties is considered. Long-term experiments lasting many years are necessary to determine such values as creep elongation limit and creep rupture strength, and to study the mechanisms of deformation and fracture. Once these are explained, the actual period of tests can be considerably reduced, using special methods.

Evaluation of open-enclosure epoxy-sealed motors. V. B. Honsinger. Elec. Mfg. *64*, 114-16 (Nov. 1959). Epoxy encapsulation techniques in motor design permit the development of an open-enclosure type that has very high resistance to environmental factors such as moisture, chemical action, etc. and retains the advantages of air cooling, light weight, etc. Tests of such motors were made under environments of ice, salt water immersion, humidity, thermal shock, high impact shock, acids, and abrasive atmosphere. In all of the tests the epoxy **(To page 56)**

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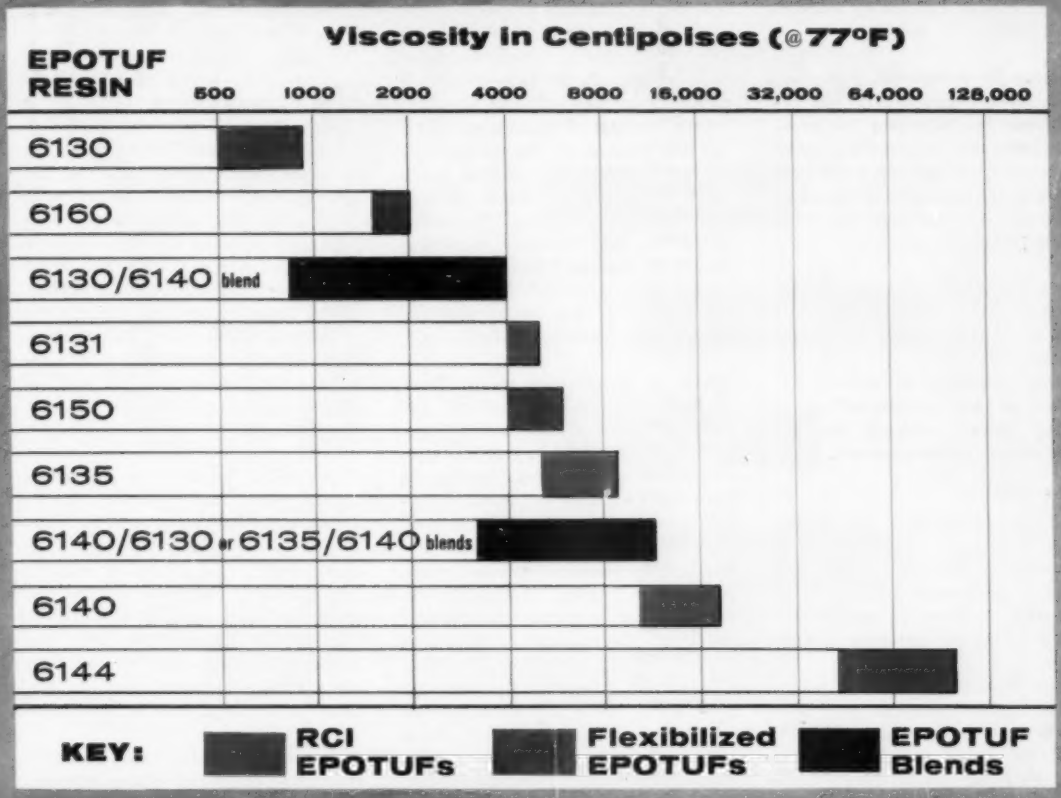

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(From page 54)

coating provided adequate protection, failure occurring in the unprotected metal components.

Polyurethane coatings. Ind. Eng. Chem. *51*, 1381-88 (Nov. 1959). Applications and properties of urethane resin coatings are discussed in a series of 8 short articles by workers in this field.

Adhesives for prostheses. Adhesives Age *2*, 36-8 (Nov. 1959). The requirements for adhesives for prosthetic parts are discussed. Special requirements are necessary not only because of the hydrophillic nature of the human skin but also the toxic problems involved.

Polyvinyl acetate copolymers for adhesives. G. T. Butts. Adhesives Age *2*, 20-24 (Oct. 1959). The effects of compounding ingredients on the adhesive properties of several copolymers of vinyl acetate with vinyl stearate, dibutyl maleate, and an acrylic monomer are reported.

Properties

Attack of polystyrene by insect larvae. J. Eggert and H. Hopff. Kunststoffe *49*, 323 (July 1959). Fly maggots or their secretions appear to attack the surfaces of polystyrene boxes in which fly eggs were stored.

Dynamic elasticity modulus of poly(methyl methacrylate) at very low frequencies. J. Koppelmann. Kolloid-Z. *164*, 31-34 (1959). The dynamic modulus of elasticity for poly(methyl methacrylate) was obtained in the frequency range of 10^{-1} to 10^{-4} cycles/sec. and a temperature range of 20 to 150° C. Dynamic modulus of thrust was determined between 20 and 100°. Poisson's constant was found to be, within experimental error, independent of temperature in the frozen range. The measured static and dynamic values in the retardation experiment in the main dispersion range agree with accepted patterns.

New polyurethane laminates show good flexural strengths. A. P. Bonnani. Space Aeronautics *32*, 87-88, 90, 92 (Aug. 1959). The properties of glass fiber laminates that are made with various types of polyurethanes are presented.

The influence of chemical structure upon the physical properties of polymers of the lower ring-alkylated styrenes. T. E. Davies. Brit. Plastics *32*, 283-85 (June 1959). Ring-alkylated styrenes may lead to production of polymers with better impact properties, higher heat distortion temperatures, better solvent resistance, and improved non-crazing properties with less effect on molding and optical properties than are presently obtained with blends and copolymers of styrene-acrylonitrile resins. Basic information is available on the influence of chain length, degree of branching, number and position of ring substituents on the properties of styrene polymers. Certain substituents produce undesirable crosslinking, "popcorn" formation, and extreme reactivity. The most important substituted styrene resins appeared to be those substituted at the ortho position, with highly branched substitutes.

Effect of radiation on plastic films. C. F. Bersch, R. R. Stromberg, and B. G. Achhammer. Modern Packaging *32*, 117-21, 166 (Aug. 1959). Several types of commercial packaging films were exposed to gamma radiation produced by a cobalt-60 source. The films studied included high and low density polyethylene, polyesters, polystyrene, rubber hydrochloride, saran, and polymonochlorotrifluoroethylene. The extent of radiation damage was determined by mass spectrographic analysis of gaseous products evolved, and by infra-red analysis of the exposed films. As a result of these analyses, the most promising packaging material for use with irradiated foodstuff appears to be polystyrene.

Factors affecting durability of glass-reinforced polyester plastics. A. L. Smith and J. R. Lowry. Plastics Tech. *5*, 42-48, 50 (June 1959). The results of outdoor and laboratory weathering tests on various types of glass fiber reinforced polyester plastics are presented. These results are related to the chemical structure of the polyesters as well as to their modifying agents.

Creep behavior of transparent plastics at elevated temperatures. F. L. McCrackin and C. F. Bersch. SPE J. *15*, 791-96 (Sept. 1959). Three acrylic and two polyester transparent plastics materials were evaluated for creep resistance. Simple creep measurements were made on these materials when subjected to various tensile stresses at elevated temperatures. Specimens were heated on both faces either at the same or at different temperatures. Some biaxial stress measurements were also obtained. A theory is given for the prediction of creep elongation of these types of plastics when exposed to temperature differentials under either uniaxial or biaxial stress.

Dimensional changes in systems of fibrous macromolecules: polyethylene. L. Mandelkern, D. E. Roberts, A. F. Diorio, and A. S. Posner. J. Am. Chem. Soc. *81*, 4148-57 (Aug. 20, 1959). Anisotropic changes occurred in the length of oriented fibers of polyethylene (PE) as a result of crosslinking by means of ionizing radiation. The length in the isotropic state subsequent to the crosslinking process increased with increasing crosslinking. In the case of highly oriented PE fibers greater elongation occurred in the liquid state. On recrystallization a preferential axial crystalline orientation developed without the application of any external force. A reversible contractile system resulted without the necessary maintenance of any external force.

Improved light stability for plasticized poly(vinyl chloride). P. R. Graham, J. R. Darby, and B. Katlafsky. J. Chem. Eng. Data *4*, 372-78 (Oct. 1959). The effects of various derivatives of benzophenone as ultra-violet light stabilizers for PVC plastics are investigated. The absorption characteristics of the stabilizers are correlated with the results of artificial weathering tests.

Diffusion of small molecules in semicrystalline polymers: Water in polyethylene. C. H. Klute. J. Applied Polymer Sci. *1*, 340-50 (May-June 1959). Published data on the solubility properties and diffusion coefficients for water in polyethylene vary over a 14-fold range. Solubilities vary less from specimen but do so in order opposite to that of the diffusion coefficients. The permeability coefficients vary much less than do the diffusion coefficients. In an examination of the permeation process, as it occurs through semicrystalline polymer films, a systematic error is introduced if permeation through such films is described by means of equations developed for homogeneous materials. The error is evaluated by means of an electrical analog and equations describing diffusion in semicrystalline polymers are derived which complement those already in existence for diffusion in homogeneous polymers. With these equations, variations (To page 175)

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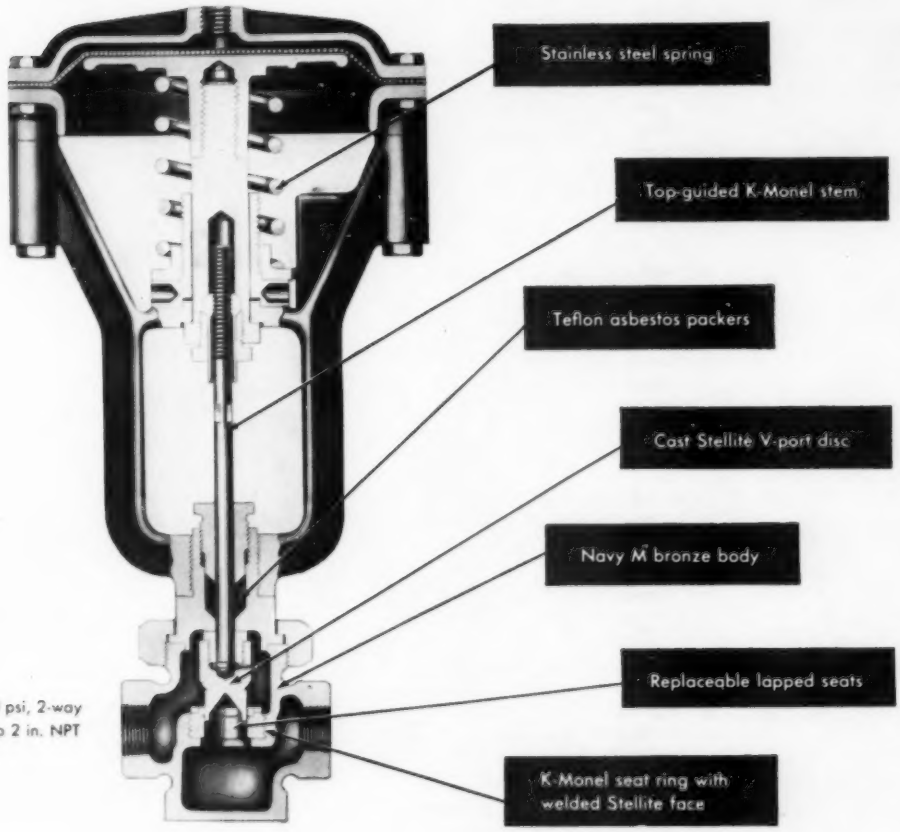

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U.S. PLASTICS PATENTS

Copies of these patents are available from the U. S. Patent Office, Washington, D. C., at 25¢ each.

U.S. Pats., Oct. 13, 1959

Graft copolymers. R. W. Rees (to Shawinigan). 2,908,662.

Epoxide polymers. W. J. Belanger, J. E. Masters, and D. D. Hicks (to Devoe & Raynolds). 2,908,663,-4-5.

Emulsion polymerization. W. B. Reynolds, J. E. Wicklatz, and T. J. Kennedy (to Phillips). 2,908,668.

Olefin polymerization. H. J. Hagemeyer Jr. and M. B. Edwards (to Eastman Kodak). 2,908,669-70.

Olefin polymerization. N. N. Hochgraf, L. C. Kenyon Jr., and A. W. Langer (to Esso). 2,908,671.

Diolefin polymerization. H. L. Jackson (to Du Pont). 2,908,672-3.

Olefin polymerization. G. Nowlin and H. D. Lyons (to Phillips). 2,908,674.

Polyethylene. K. P. Lindland (to Du Pont). 2,908,675.

U. S. Pats., Oct. 20, 1959

Polyamine-polyepoxide adducts. C. W. Schroeder (to Shell). 2,909,448.

Oxetane polymers. W. M. Schilling (to Hercules). 2,909,492.

Resinifying polyepoxides. H. L. Parry and J. E. Carey (to Shell). 2,909,494.

Ethoxyline resin composition. J. Rosenberg (to General Electric). 2,909,495.

Polyepoxides. H. G. Cooke, Jr. and J. E. Masters (to Devoe & Raynolds). 2,909,496.

Epoxide resins. L. E. Edelman (to Westinghouse). 2,909,497.

Alkadienedioate - fumarate adducts. J. Dazzi (to Monsanto). 2,909,500.

Fire-resistant polyesters. P. Robitschek and J. L. Olmstead (to Hooker). 2,909,501.

Alkali-soluble resins. S. O. Greenlee (to S. C. Johnson). 2,909,505.

Acrolein-pentaerythritol resins. H. R. Guest, J. T. Adams, and B. W. Kiff (to Union Carbide). 2,909,506.

Polyvinyl acetals. R. H. Cahill, C. A. DeFazio, and J. C. Lukman (to Celanese). 2,909,507.

Acrylamide-vinyl aromatic sulfonate copolymers. G. D. Jones (to Dow). 2,909,508.

Fluorine-containing polymers. G. H. Crawford, Jr. and E. Shen-Lo (to Minnesota Mining). 2,909,509.

Copolymers of monovinyl methyl siloxanes and chlorotrifluoroethylene. D. L. Bailey and R. M. Pike (to Union Carbide). 2,909,548-9.

U. S. Pats., Oct. 27, 1959

Interpolymers of vinylphenyl aliphatic aminocarboxylic acid. R. A. Mock, C. A. Marshall, and L. R. Morris (to Dow). 2,910,445.

Glycidyl polyethers. R. M. Christenson and W. C. Bean (to Pittsburgh Plate Glass). 2,910,455.

Copolyamide. S. C. Temin and M. Levine (to Industrial Rayon). 2,910,-457.

Addition-type copolymers. H. S. Rothrock and C. W. Tullock (to Du Pont). 2,910,459.

Polyaluminum oxide carboxylates. J. Rinse (to J. W. Ayers). 2,910,494.

U. S. Pats., Nov. 3, 1959

Water-soluble phosphonic acid polymerizates. J. I. Bregman (to National Aluminate). 2,911,378.

Polyether compositions. J. D. Doedens (to Dow). 2,911,380.

Reinforced butadiene - acrylonitrile. J. B. Doughty (to West Virginia Pulp & Paper). 2,911,383.

Polypropylene. W. E. Thompson and G. S. Leeder (to Sun Oil). 2,911,384.

Vinyl aromatic polymers. W. K. Schweitzer, Jr. (to Dow). 2,911,385.

Polymer hydroperoxides. E. J. Vandenberg (to Hercules). 2,911,387; 2,911,391; and 2,911,398.

Condensation products. H. Weisbart and W. Forster (to Reichhold). 2,911,388.

Phosphinate copolymers. J. C. Pernert (to Hooker). 2,911,389.

Fluorinated polyurethanes. D. D. Smith (to Dow). 2,911,390.

Petroleum resins. A. B. Small (to Esso). 2,911,395.

Copolymers of fluoro-1,3-dienes. A. N. Bolstad and F. J. Honn (to Minnesota Mining). 2,911,396.

U. S. Pats., Nov. 10, 1959

Polymers of divinylbenzene dioxide. B. Phillips, C. W. McGary, Jr., and C. T. Patrick, Jr. (to Union Carbide). 2,912,389.

Resin from dihaloalkylxylene and polyalkylene polyamines. J. J. Jaruzelski (to Pittsburgh Plate Glass). 2,912,390.

Modified polyesters. P. R. Cox, Jr. (to Chemstrand). 2,912,404-5.

Diisocyanate resin. G. Nischk and K. E. Muller (to Mobay and Bayer). 2,912,408-9.

Polyethylene-polybutadiene composition. Q. P. Cole (to General Electric). 2,912,410.

Aziridine-phenolic polymer. W. A. Reeves, J. D. Guthrie, and L. Chance (to United States). 2,912,412.

Non-electrostatic polystyrene. M. Baer (to Monsanto). 2,912,413.

Polyurethanes. H. Schultheis, W. Kallert, and D. Delfs (to Bayer and Mobay). 2,912,414.

Pyrrolidone polymerization. W. B. Black and H. G. Clark (to Chemstrand). 2,912,415.

Amide copolymers. H. A. Newey (to Shell). 2,912,416.

Polyethylene. F. E. Bailey, Jr. and F. J. Welch (to Union Carbide). 2,912,425.

U.S. Pats., Nov. 17, 1959

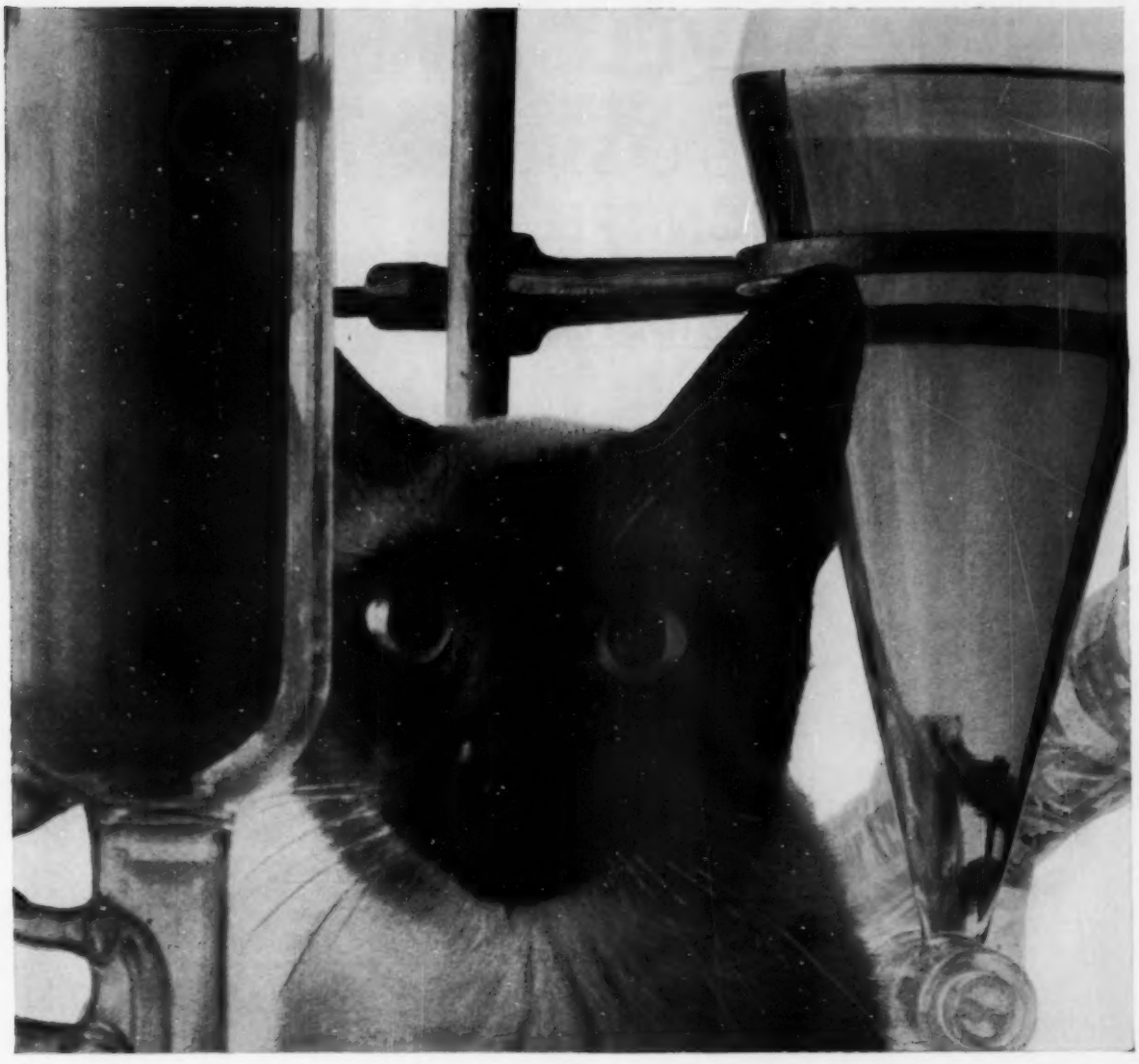
Acrolein - pentaerythritol condensates. H. R. Guest, J. T. Adams, and B. W. Kiff (to Union Carbide), 2,913,434.

Phosphorus - containing polyesters. W. A. Reeves and J. D. Guthrie (to U. S.). 2,913,436.

Olefin-maleic anhydride copolymers. J. H. Johnson (to Monsanto). 2,913,-437.

Acrylonitrile - alkenylaromatic sulfonate copolymers. C. W. Davis, F. A. Ehlers, and T. G. Traylor (to Dow). 2,913,438.

Hydroxy - containing copolymers. A. A. Bondi and L. B. Scott (to Shell). 2,913,439.—**End**



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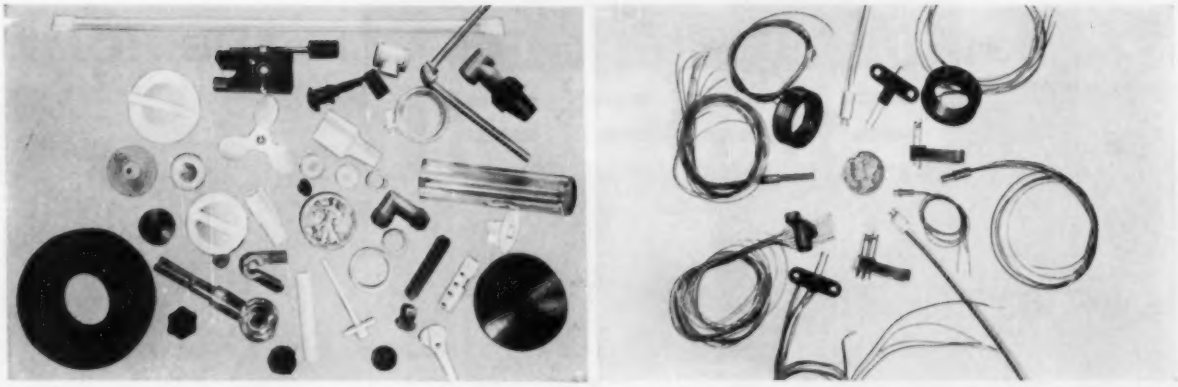

The endless variety of plastic items, sub-miniature to 1½ oz., precision-molded on versatile MINI-JECTORS is suggested in these pictures of parts made on these machines. Even parts involving inserts or loose cores are production molded. Relative size of parts is indicated by half-dollar in left picture and dime in right.

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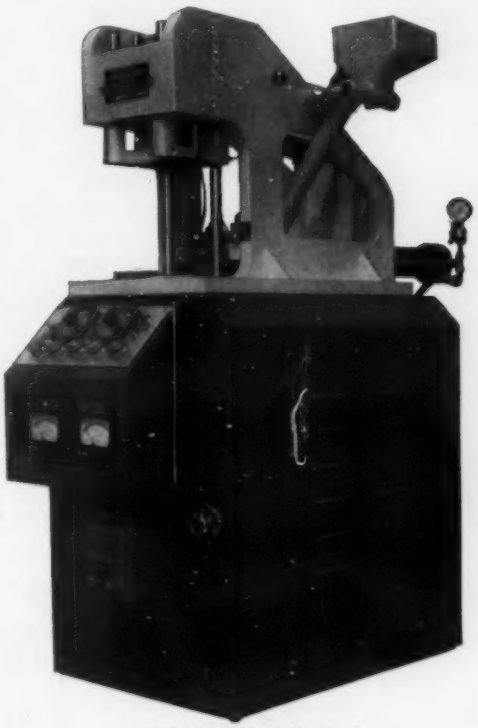

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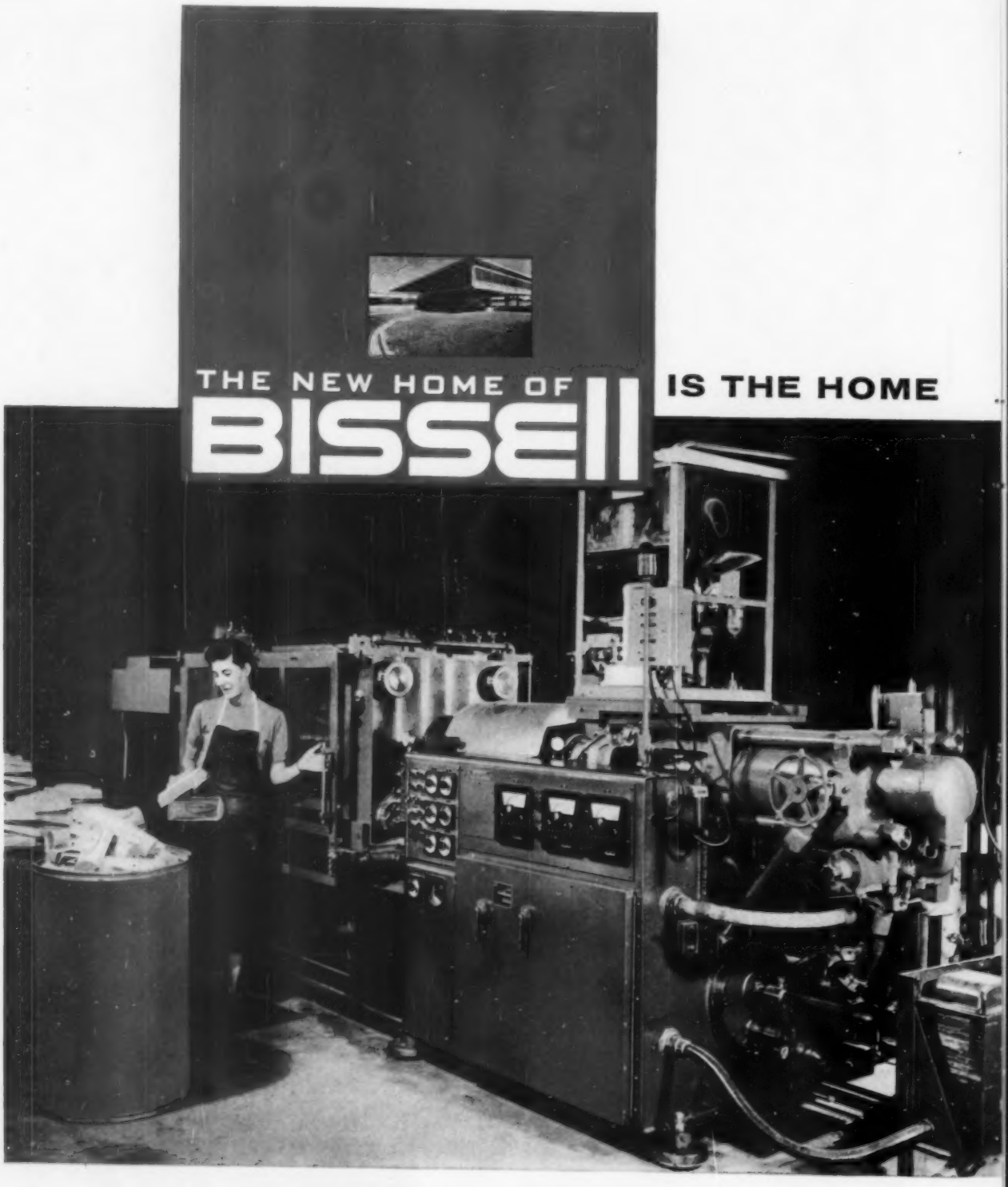
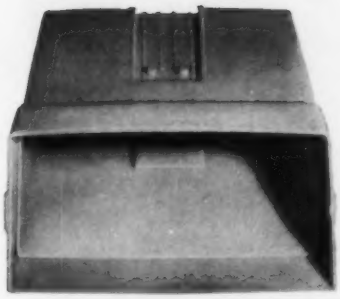


Fellows

injection molding equipment



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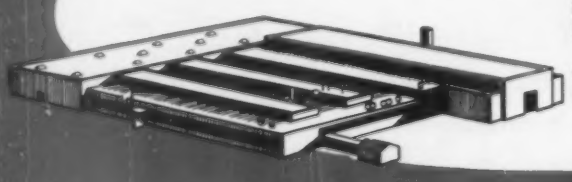

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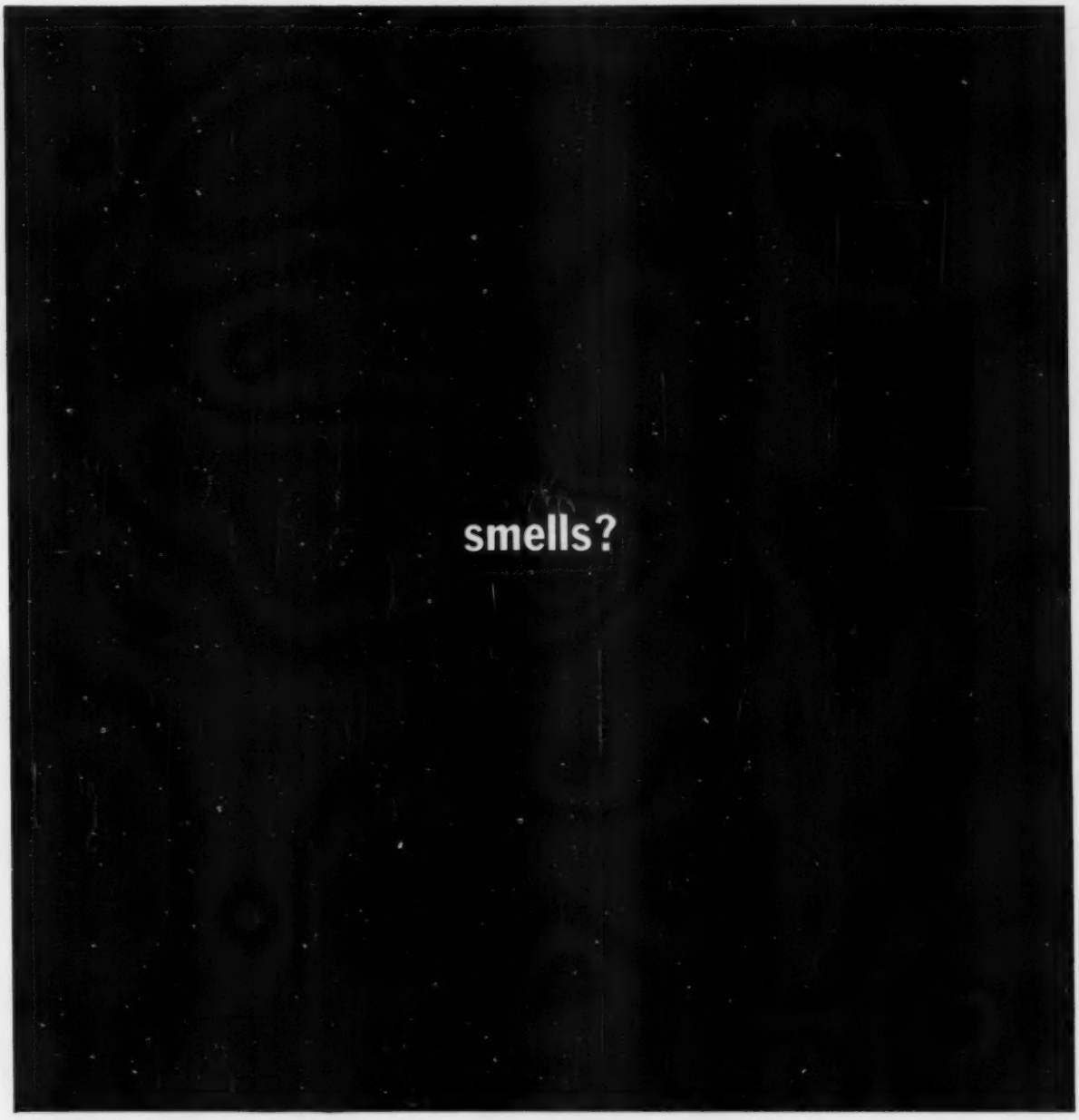

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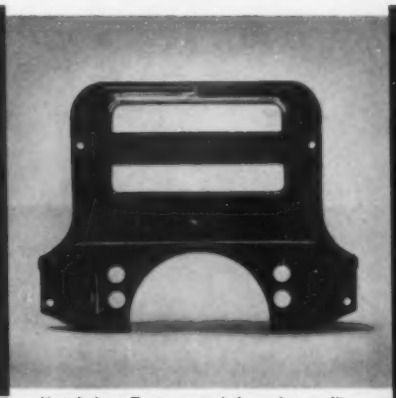

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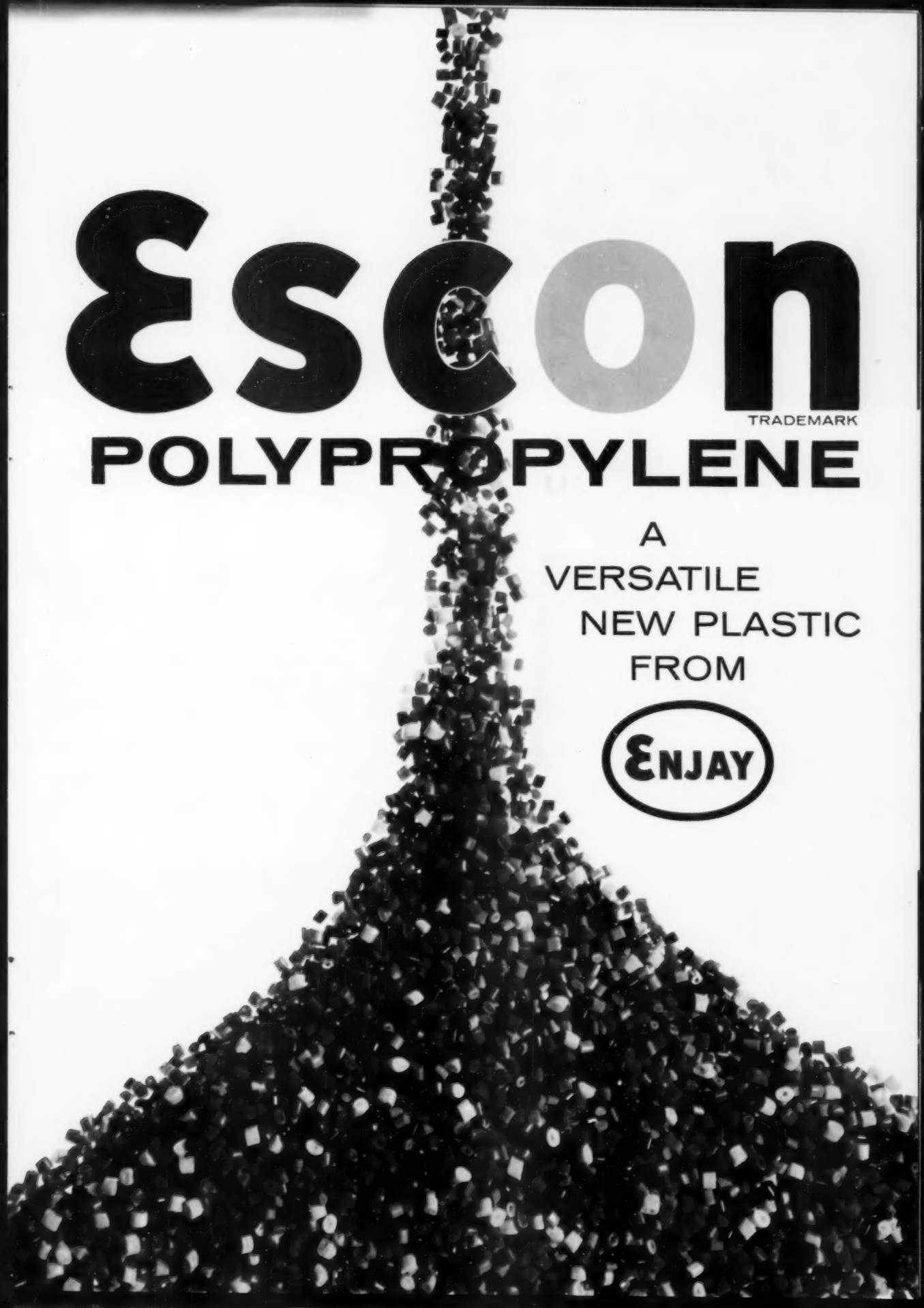
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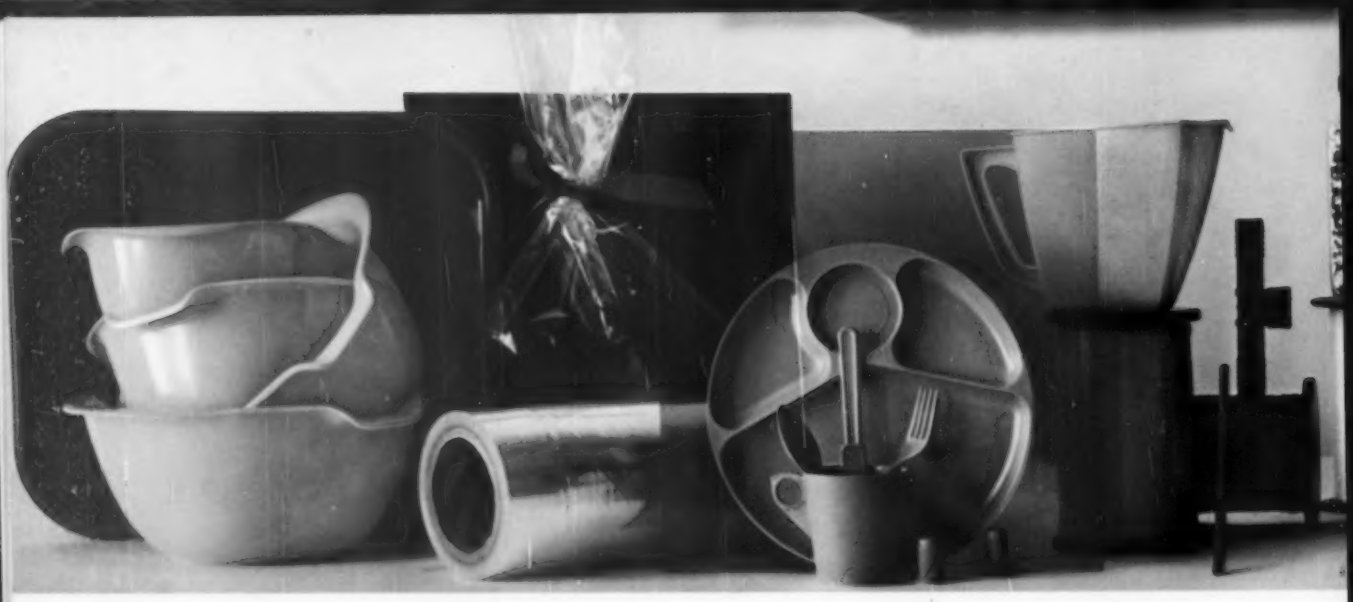

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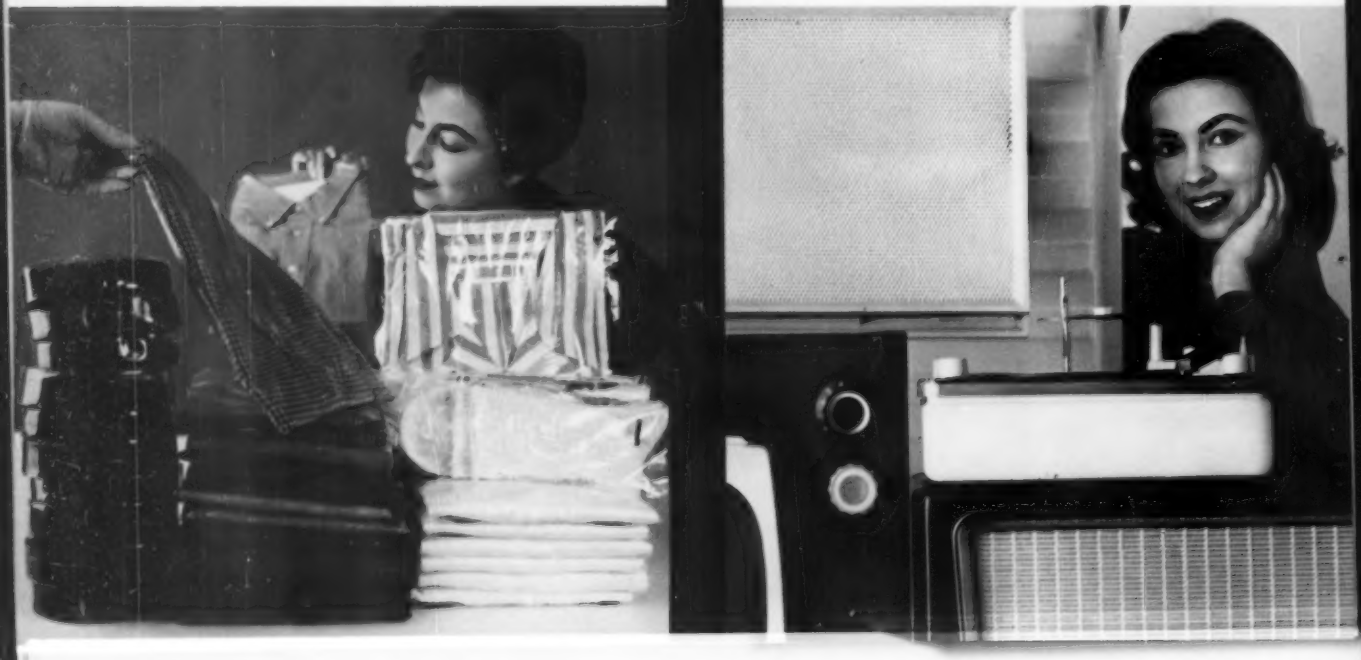

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molded; extruded into film, sheet and shapes. It can also be drawn and vacuum formed, heat sealed, machined and printed. Because of the rigid manufacturing standards of the Enjay Company, molders and designers are assured of high uniform quality whenever they specify Escon polypropylene. Versatile Escon can be tailor-made to meet a variety of product needs.

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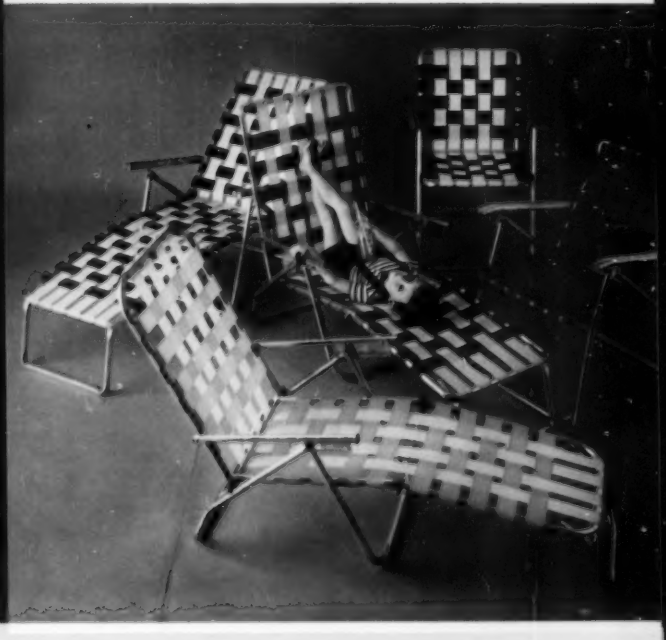

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density, 73°F., g./cc.	0.897-0.910	ASTM D1505-57T
melt index, @250°C., g./10 min.	1-10	ASTM 1238-57T (load, 2,160g.)
environmental stress cracking (100% Igepal CD-630)	none	Bell Labs.
burning rate	slow	ASTM D635
machining qualities	excellent	
mold shrinkage, in./in.	0.015-0.030	
water absorption, %	< 0.01	ASTM D570-57T
yield strength, psi, 2"/min.	3800-5100	ASTM D638-58T
tensile strength, psi, 2"/min.	3500-4900	ASTM D638-58T
yield elongation, %, 2"/min.	13-18	ASTM D638-58T
ultimate elongation, %, 2"/min.	22-315	ASTM D638-58T
Impact strength, ft.-lb./in.		ASTM D256-54T
Izod notched	1	
Izod unnotched	> 16	
hardness		
Rockwell R	80-90	ASTM D785-51
Shore D	70-75	ASTM D676-55
elastic modulus, psi, 2"/min.	45,000-60,000	ASTM D638-58T
flexural modulus of elasticity, psi, 2"/min.	111,000-176,000	ASTM D790-58T
flexural modulus of rupture (flexural strength), psi, 0.05"/min. (no break-max. load)	65,000-81,000	ASTM D790-58T
compressive yield stress, psi, 0.05"/min.	5,300-6,400	ASTM D695-54
compressive strain @yield, %, 0.05"/min.	15	ASTM D695-54
compressive elastic modulus, psi, 0.05"/min.	53,000-63,000	ASTM D695-54
stiffness in flexure, psi	95,000-150,000	ASTM D747-58T
modulus of elasticity, psi	100,000-128,000	ASTM D1043-51
Taber abrasion, mg. loss/1000 cycles (CS-17 wheel, 1000g. load)	29-32	
melting point, °F.	335	polarizing microscope
vicat softening point (1 kg.), °F.	266-293	ASTM 1525-58T
deflection temperature		ASTM D648-56
°F. @264 psi fiber stress	131	
°F. @66 psi fiber stress	188	
coefficient of thermal conductivity		
cal./cm./cm.²/sec./°C.	2.80×10^{-4}	
BTU/in./ft.²/hr./°F.	1.13	
coefficient of linear thermal expansion in./in./°C.	0.00020	ASTM 696-44
specific heat @73°F., cal./g.	0.46	
ELECTRICAL PROPERTIES		
volume resistivity, ohm-cm	6.5×10^{16}	ASTM D257-54T
dielectric strength, volts/mil		
short-time, 1/8" thickness	660	ASTM D149-55T
step-by-step, 1/8" thickness	650	
dielectric constant, 10^6 cycles	2.0	ASTM D150-54T
dissipation (power) factor, 10^6 cycles	0.0002-0.0003	ASTM D150-54T

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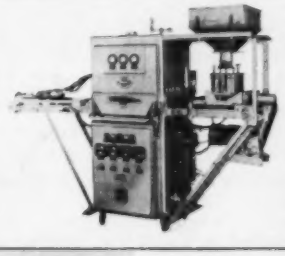

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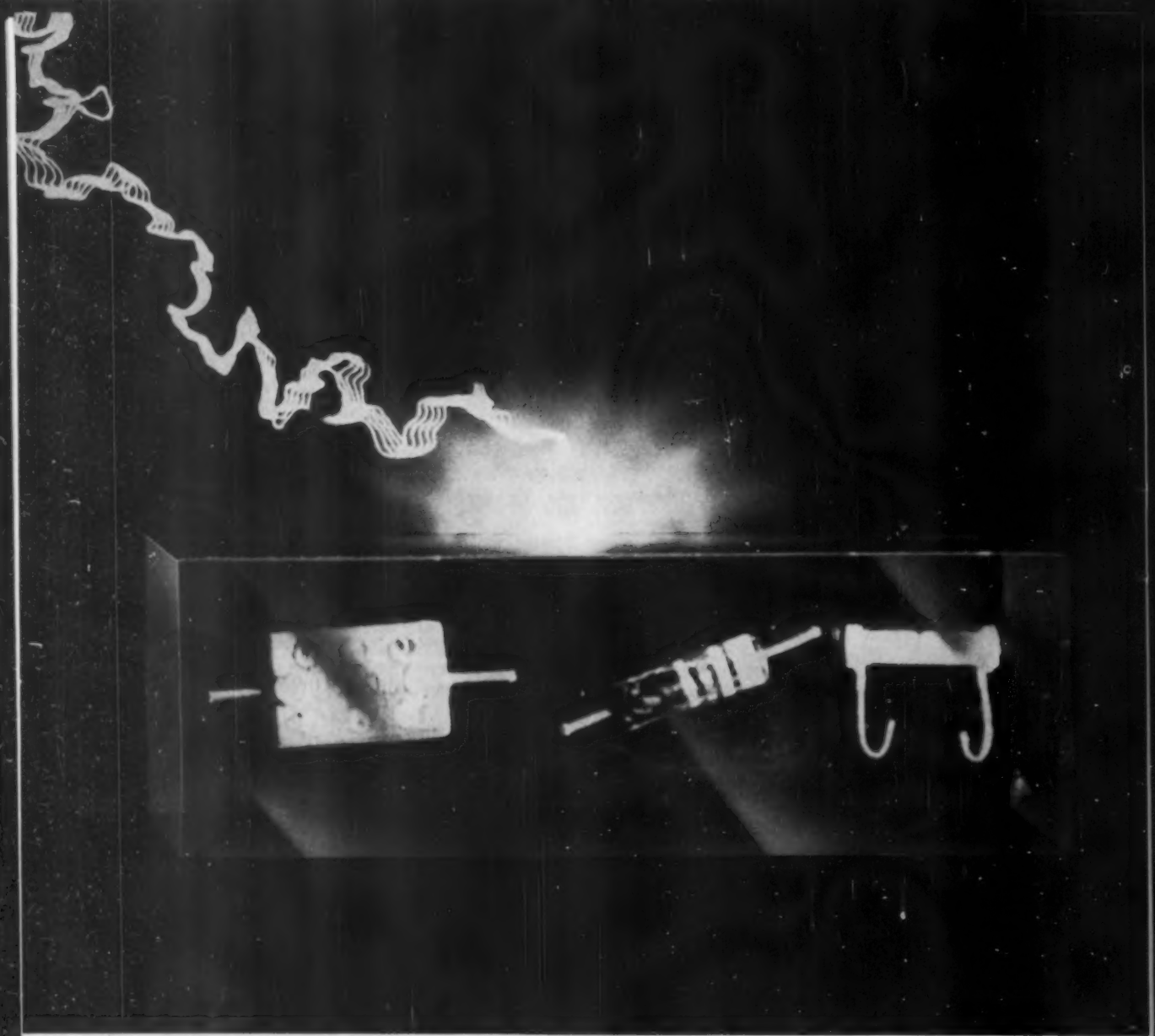

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No matter what the process, whether encapsulating, embedding, potting or casting, GLIDPOL resins are formulated to provide not only the right protective barrier against high voltage but humidity, impact, vibration, corrosion and chemicals as well. And they can easily be pigmented in a wide range of colors.

Write for complete information on the GLIDPOL polyester resin system best designed to meet your particular protective requirements.

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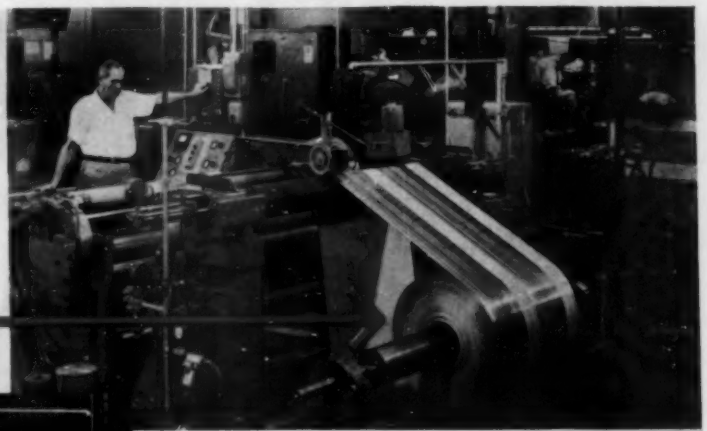
There's a GLIDPOL Polyester Resin system, plus Glidden Technical Service, to help you do it better, more economically, whatever your product, process or problem.

How MILPRINT gets

THE NEW ROLL

...the highly perfected finished roll produced on an integrated unwinding-slitting-rewinding system engineered by Cameron specialists.

On this integrated Milprint installation *The New Roll* is running 24 hours a day in straight slitting-rewinding and in rewinding-inspection operations. The material, lightweight printed laminated foil, demands:



Integrated Control ...from parent roll

to perfect finished rolls

On this integrated system the parent roll feeds from a Cameron Unwind Stand equipped with several control features including a Cameron Model KW Continuous Duty Brake. Control signals flash through the sensitive Cameron Model 900 Constant Tension with electronic side-register guiding to a printed line. With differential surface-and-center rewind, perfect control is maintained right through to finished rolls on the Cameron 620 slitter-rewinder, using Cameron Pneucut pneumatic score-cut slitting.

The sound, modern engineering and economic principles of *integrated* roll control are being closely studied in converting plants, paper and paperboard mills, and finishing rooms everywhere.

Whether you work with papers, plastic films, metal foils, laminates or any other flexible web material, the growing competitive importance of *integrated* roll control deserves your immediate attention. A finished roll produced on a completely integrated unwinding-slitting-rewinding system is not just a better roll—it is a fundamentally different roll!

We call it *The New Roll*. Its vital new qualities of inward excellence meet and exceed the new standards required in modern high speed, long-run printing, converting and finishing operations.

Get The New Roll Now!

The Cameron team of specialists maintains extensive testing, development and information services adapting *The New Roll* to flexible web materials of all types. You are invited to make use of these facilities at any time. See what *integrated* roll control can do for you. Write, wire or telephone to:

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54 years devoted exclusively to the design and manufacture of slitting, roll winding, unwind and web control equipment.

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True clarity—Resists mold deposits—Bright colors

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Excellent resistance to low-temperature heat-yellowing
Excellent resistance to early light-yellowing

3 **FERRO 2035 for CALENDERING**
Long-term, high heat stability—Resists "plateout"
Non-pinking—Complete compound compatibility

All three stabilizers have been thoroughly tested, are now available for *immediate* use. All three offer definite advantages: in processing...in quality and properties of the finished products...in reducing costs, *substantially* in some instances.

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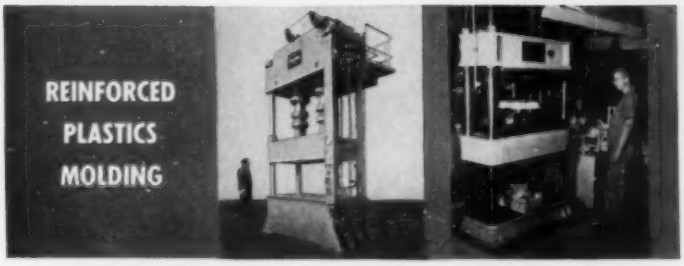
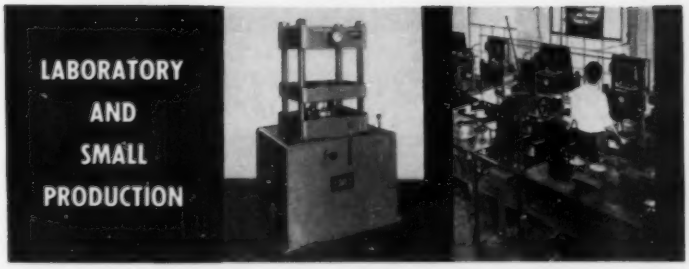
For YOU, too . . .

Elmes can turn pressing problems into profit-making performance!





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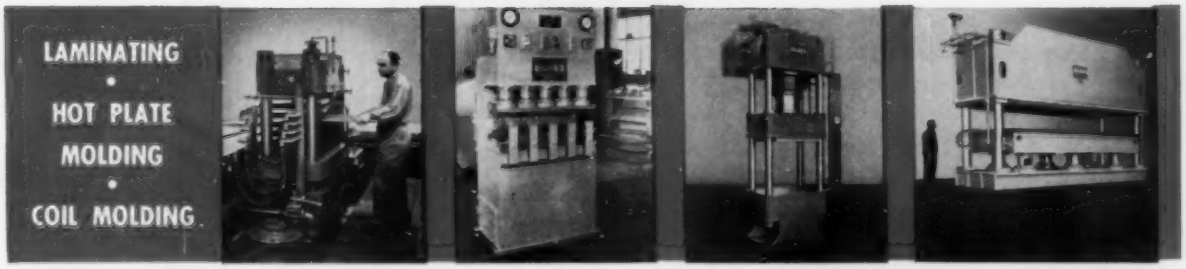

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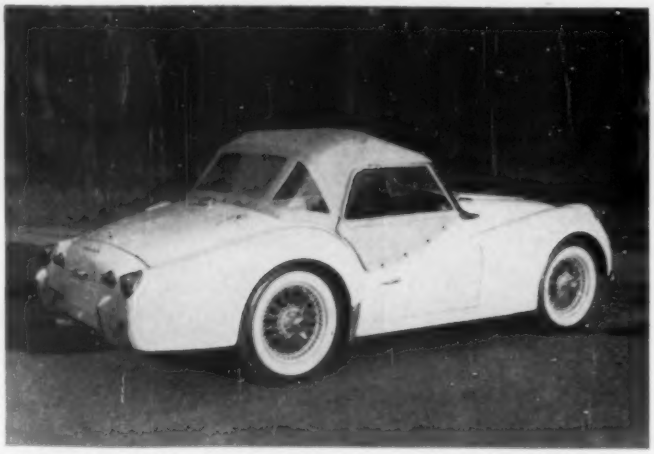
More and more 'Perspex' is being used in modern cars

Heinkel car sold by International Sales Ltd., showing side windows and rear dome made from 'Perspex' acrylic sheet by P.D.I. Ltd., Birmingham.



Sliding side windows made from 'Perspex' acrylic sheet by Coventry Hood and Sidescreen Co. Ltd., Bedworth near Coventry, in Triumph car manufactured by The Standard Motor Co. Ltd.

'Cyclone' weather shield made from 'Perspex' acrylic sheet by Cyplas Industries (England) Ltd., Colne, Lancs, on Morris Minor 1000.

In modern cars great use is being made of 'Perspex' acrylic sheet—are you making full use of this truly outstanding material? 'Perspex' offers excellent clarity in clear form as well as an extremely high degree of light transmission in tinted form. It is light in weight and it can be formed to smooth, modern streamlined shapes. Another great advantage 'Perspex' offers is toughness. It has long been established that 'Perspex' stands up to weather conditions throughout the world. Finally, 'Perspex' is a handsome, long-lasting material, a material modern car owners are glad to have in their cars.

'PERSPEX'

'Perspex' is the registered trade mark for the acrylic sheet manufactured by I.C.I.

P.759/O/A

Imperial Chemical Industries Limited, Plastics Division: Export Dept., Black Fan Road, Welwyn Garden City, Herts.

U.S.A. *enquiries to:* J. B. Henriques Inc., 521 Fifth Avenue, New York 17, N.Y.

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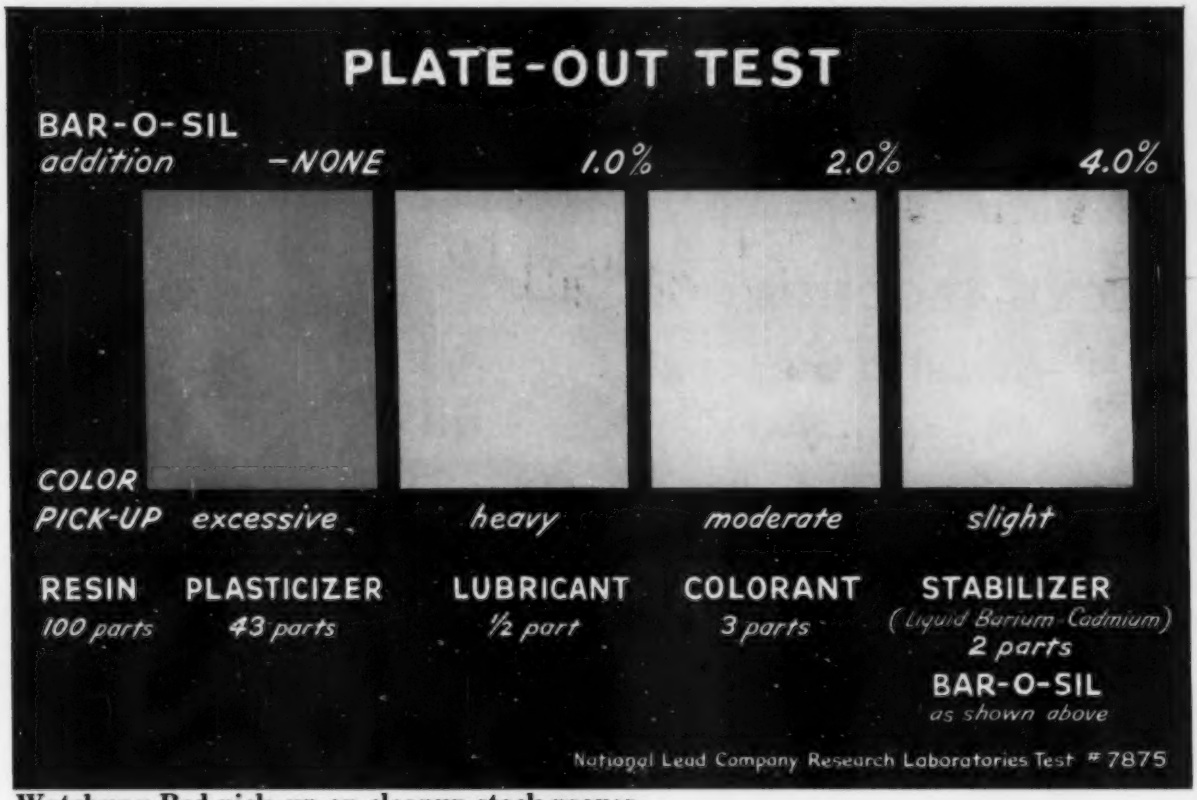

Watchung Red pick-up on cleanup stock proves...

novel new supplementary stabilizer gives best-yet control of plate-out

No need to change barium-cadmium stabilization base!

There is a standard vinyl industry test of plate-out. Recently, at National Lead Laboratories, we used it to evaluate a new and novel approach to the control of plate-out . . . with gratifying results.

Test procedure was simple. BAR-O-SIL*, a newly developed National Lead barium-silicate supplementary stabilizer, was added in varying quantities to a number of different barium-cadmium-stabilized stocks heavily overloaded with Watchung Red. Immediately after calendering each sample, a cleanup compound was run. Degree of color pick-up indicates degree of plate-out control established by given levels of BAR-O-SIL stabilizer content. In our many tests, the reduction of color pick-up has always been proportional, depending on extent of plating initially present.

Stop one production run, start the next... in minutes without cleanup

As you can see, BAR-O-SIL stabilizer provides an interesting new tool for plate-out control in barium-cadmium-stabilized stocks. Now it's practical to run color after color in quick succession.

Best of all, this unique supplementary stabilizer provides plate-out control without affecting proven (or new) stabilizations, without altering sensitive colorants, and without increasing yellowing or susceptibility to staining.

BAR-O-SIL stabilizer has several additional desirable effects . . . adds heat stability; sharply reduces hazing, crocking, spewing; controls migration of plasticizer. In calendered products, it imparts a very pleasing dry hand.

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BAR-O-SIL*
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910 South Michigan Avenue, Chicago 80, Illinois

March 1960, Volume 37, Number 7

MODERN PLASTICS

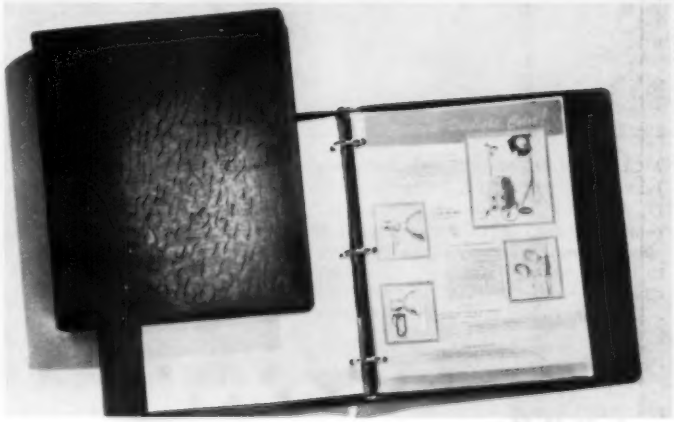
POLYPROPYLENE—a product evaluation

With polypropylene now being produced at the rate of about 30 to 50 million lb. a year, processors and end-users seem to have suddenly become aware that there's going to be a great deal of the material around—and in a very short time! Depending on whose statistics you look at, there will probably be between 300 to 500 million lb. of polypropylene resin on the market sometime between 1962 and 1963. The question is: where is it all going to go? Currently, injection molded applications account for the bulk of consumption. Monofilaments are coming up fast. Film is just beginning to move out of an intensive market evaluation program, but is already being touted as a serious competitor to polyethylene film and cellophane in the overwrap market. Suppliers are so confident of its potential that they

Hinged applications

Dozens of manufacturers of products ranging from dishwashers to fishing tackle boxes are already tooling up to produce molded one-piece components with integral hinges and snap-catches. Spectacle cases (at right) were the first application to be designed around the principle. Then, last year, Columbus Plastic Products Inc., Columbus, Ohio, using the same design concept, introduced a portable luggage-type record carrying case that also seemed to be of much interest to manufacturers of conventional luggage. Now Crawford Industries, Crawfordsville, Ind. has come out with a molded polypropylene three-ring binder (right) that uses the integral hinge concept for the backbone of the book. The future possibilities are obvious. The one-piece construction can reduce production and assembly operations to the point where manufacturers can market a quality product at low cost.

PHOTOS, HERCULES POWDER CO. INC.



PHOTO, SPENCER CHEMICAL CO.

Appliances

This has turned out to be one of the most lucrative and fast growing areas of volume usage. Practically all major manufacturers of dishwashers have at least one part molded of polypropylene. In all cases, the reasons for use were similar: heat resistance; resistance to chemical attack by the alkalies present in dishwasher detergents; a glossy finish that resists scuffing; integral color; impact strength; adaptability to flexible or rigid design as required—and all at a lower cost than the metals previously required to perform the job. Using polypropylene instead of stainless steel, Waste King Corp., Los Angeles, Calif., economically redesigned the water distribution system for their Universal dishwasher-dryer. The major component: a molded polypropylene distributor arm. Other polypropylene parts: an axial flow impeller on the main water pump (replaces die cast aluminum); flexible trim rings and grommets; detergent cups (replace nylon and phenolic); and molded rails.

PHOTO, HERCULES POWDER CO. INC.

BY REDUCING multiple fabricating and finishing steps previously required to a single molding operation, the polypropylene silverware basket in Westinghouse's Imperial dishwasher has proved less costly than the vinyl plastisol-coated steel wire mesh generally used.

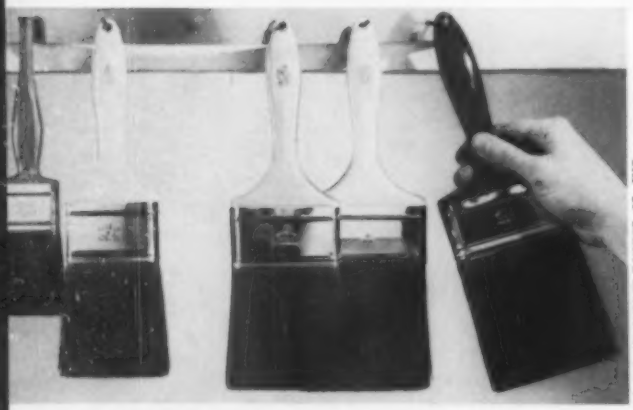
predict a total film consumption which will exceed injection molding and monofilament combined—close to half the total market—by the mid-'60's.

Since the film is too new for consideration, however, this product evaluation study will be devoted strictly to injection molded applications and monofilament uses.

In preparing this study, the editors queried manufacturers using polypropylene as to why they selected the material and what success they have had with it. Their comments appear with the photographs on the accompanying pages and cover pro and con.

On the positive side of the ledger, here are the characteristics of polypropylene cited most often as reasons for its selection:

1) Despite its light weight (it's the lightest



PHOTO, HERCULES POWDER CO. INC.

MOLDED POLYPROPYLENE hollow paint brush handles by H. V. Hardman Co. Inc., Belleville, N. J., cut manufacturing costs since " . . . it is unaffected by humidity change and storage . . . speeds handle assembly and eliminates rejects due to shrinking and swelling; also splitting during assembly (with nails) . . . impervious to solvents . . . will not chip, crack, peel, or loosen."

Industrial uses

Polypropylene's physical properties come close to those of metals in many non-critical applications; it can be precision molded in one piece complete with integral assembly mounts; and it offers characteristics that metal cannot match at the same price. As a result, the material has started to move into a number of industrial applications.

The hood for the rotary lawn mower manufactured by Power Equipment Inc., Cicero, Ind., is already being advertised in company literature as "enhancing appearance . . . muffling engine . . . resistant to temperatures up to 285° F., down to 0° F. (will not chafe or crack)." Another shroud is shown at right. Polypropylene pipe fittings (especially for polyolefin pipe) and pump components are also already in commercial production.

plastic with a specific gravity of 0.89 to 0.91), polypropylene is exceptionally tough and rigid. Most of its mechanical properties are reportedly somewhat superior to linear polyethylene and somewhat inferior to nylon.

2) Polypropylene has the inertness and moisture resistance typical of hydrocarbon polymers, about on a par with polyethylene. It has excellent resistance to solvents, greases, oils, and many of the common chemicals.

3) Polypropylene's heat distortion point runs up to 300° F.—higher than most thermoplastics materials and high enough to permit sterilization of the molded product.

4) Surface finish of the molded end-product is outstanding in terms of gloss, smoothness, and feel.

5) Polypropylene has good resistance to environmental stress cracking.

6) The fact that polypropylene's shrinkage is virtually the same in all directions tends to reduce any warping tendencies.

The survey also revealed particular mention of the adaptability of polypropylene to the design of a one-piece hinged container. The material is so flexible that a very thin section joining case and cover forms a hinge which will take a 180-degree bend many times over without failure. Tests of up to 300,000 successful flexes (part of which was performed at −20°F.) have been reported. The material is also sufficiently resilient so that the snap-fastener prin-

OUTDOOR furniture webbing (produced with polypropylene fibers by Arvin Industries Inc., Columbus, Ind.) offers "weather-resistant features . . . plus resiliency that prevents fibers from tightening and causing warpage when constantly exposed to the sun." The polypropylene assembly clip (arrow) is molded directly to the webbing to make an integral unit that can withstand a pull of 350 to 400 lb. without breaking.

PHOTO, ARVIN INDUSTRIES INC.

Fiber and rope

Polypropylene probably won't start reaching its true potential until the mid-60's. There are still some problems to be licked, primarily its difficult dyeability, but producers feel this will be no more difficult to resolve than was the question of stability (the fibers are already being used for outdoor furniture). They yield fabrics with a luxurious appearance and feel, their melting range is higher than polyethylene or saran (but lower than nylon or Dacron), their cost is moderate (polypropylene textiles would sell for less than nylon or Dacron), they have outstanding resilience characteristics and excellent "memory," and their water, chemical, and mildew resistance are good. Rope based on PP fibers is lighter than any similar product now on the market (including manila, nylon, or Dacron), has more strength per pound than any of its rivals (except nylon), and it is more efficient—a 1½-in.-diameter PP rope will do the job of a manila rope with a 2-in. diameter.

PHOTO, HERCULES POWDER CO. INC.

NEED FOR leak-proof heat seal between two halves of a dispensing unit for a floor waxer prompted The Regina Corp., Rahway, N. J., to select polypropylene "because of its excellent sealing qualities." The molded dispenser also "proved to be less costly than if manufactured from other materials with the same chemical resistance to the turpentines in wax."

COMBINATION power mower and outboard motor produced by American Chain & Cable Co. Inc., Exeter, Pa., has polypropylene engine shroud. The material was chosen over steel, cast aluminum, high-impact styrene, and linear polyethylene because it had "best heat resistance, good finish, adequate stiffness, lack of stress and strains in the molded piece."

PHOTO, AMERICAN CHAIN & CABLE CO. INC.

ciple can be used to hold the two parts firmly together when the cover is closed. (See photo of vacuum bottle, below.)

The question of cost

Polypropylene at 42¢/lb. is higher priced than the large-volume, low-cost thermoplastics. But on a cost-per-cubic-inch basis, polypropylene works out to be less expensive than butyrate, acetate, propionate, the ABS polymers, and nylon. At 30.6 cu. in./lb., polypropylene costs approximately 1.37¢/cu. inch. Cubic-inch cost, however, is not the only consideration. Properties carry weight, too. In Coty's new aerosol package, for example, the strength and rigidity of the material was put to use in a protective molded case that eliminated any need for a protective coating on the glass bottle that fit into it. This enabled the company to apply the otherwise additional cost of a coated bottle (7½¢ as opposed to 2½¢ for the uncoated bottle) to the extra cost of polypropylene. The accompanying case studies show other similar examples.

Toys

It seems unlikely that there will be much application for polypropylene in the toy field until it becomes more competitive with polyethylene and styrene. While toy manufacturers do report its surface finish and rigidity are somewhat better, not too many applications have thus far shown up in which these characteristics are important enough to warrant the extra cost. A typical application is a molded yoke for a pull toy being manufactured by Fisher-Price Toys Inc., East Aurora, N. Y. The company cites the "memory" of the plastic as the reason for selection. Cold flow problems and breakage which occurred while assembling the wooden handle to the yoke (an interference fit) eliminated many other plastics for the job.

Closures and containers

Polypropylene moved into prominence almost from the beginning for applications requiring a high degree of chemical resistance, e.g., to the ingredients in cosmetics. Breakage of the polypropylene closures is less than styrene; cost is lower than urea. In the blown container field, low temperature impact resistance plus price seem to be holding it back from volume use in semi-rigid bottles and containers. But the material has found application in the design of injection molded specialty containers, e.g., Coty's package (see text above), which can sacrifice price for styling advantages and impact strength.

"RIGIDITY at low cost" were the prime advantages offered by polypropylene in this bookcase produced by Republic Molding Corp., Chicago, Ill., and based on the company's earlier success with polypropylene self-stacking utility shelves. (Photo, Hercules)

Housewares

Because of the price factor, penetration into this cost-conscious area has been slow—and *highly selective!* Originally, most of the new applications were based on polypropylene replacing metal, wood, glass, or other conventional materials *at a lower cost* (e.g., the bookcase and vacuum bottle illustrated here); more recently, polypropylene has been used for crispers, tumblers, and cannister sets where the upgrading of the product is sufficiently important to *justify the extra cost* over comparable polyethylene and styrene models. In dinnerware, it is not likely that the material will be a serious threat to melamine, but it will certainly compete with specialty styrene compounds for the less expensive type of patioware.

PHOTO, ALADDIN INDUSTRIES INC.

MOLDED one-piece polypropylene handle, jacket, and collar highlight a newly restyled vacuum bottle by Aladdin Industries Inc., Nashville, Tenn. Styling (including integral handle) and durability have been limited to more expensive steel-jacketed bottles.

And it is interesting to note that several manufacturers of polyethylene refuse cans are evaluating—despite additional costs—the use of polypropylene lids to provide a higher degree of rigidity and sufficient resiliency to enable the lids to "snap back" no matter how the lids are deformed.

The question of moldability

The majority of processors who answered this survey had high praise for the molding characteristics of polypropylene. (**To page 176**)

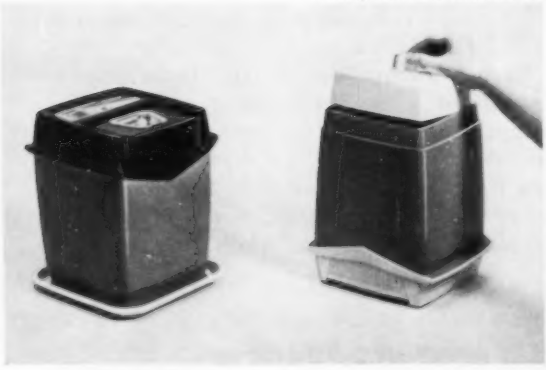
BEAKERS, weighing bottles, and funnels withstand up to 140° C. and have high resistance to chemicals and stress cracking even at that temperature. As manufactured by Pioneer Plastics, Jacksonville, Fla., the polypropylene lab ware is also rigid enough to be used under vacuum.

PHOTO, EASTMAN CHEMICAL PRODUCTS INC.

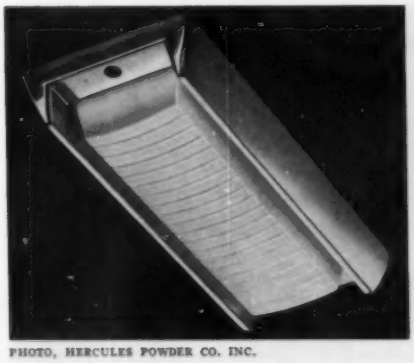
Laboratory and hospital ware

One of the earliest and still an important market for polypropylene is the type of lab and hospital ware illustrated above. Heat resistance and chemical resistance—at low cost —are highlights.

PHOTO, NORTHERN ELECTRIC CO.



IN REPLACING the traditional glass carrier in their vaporizer, Northern Electric Co., Chicago, Ill., selected a molded polypropylene unit for three reasons: 1) lower specific gravity; 2) high heat distortion temperature; 3) uniform linear thermal expansion that made it possible to design a positive assembly with the phenolic vaporizer head. For their sterilizer unit (right), lid (with integral knob) molded of polypropylene replaced drawn anodized aluminum cover (which showed up unattractive die marks).



POLYPROPYLENE dome light lens has been satisfactorily in service for the past two years. Lens passed a series of rugged tests, including exposure to a 300° F. temperature for 5 hours. Light stability has proved excellent, with no darkening of lenses thus far reported.

PHOTO, HERCULES POWDER CO. INC.

VAPORIZER-HUMIDIFIER manufactured by Hankscraft Co., Reedsburg, Wis., uses vessel and cover molded of polypropylene. The two parts are joined together by spin welding technique (cover is rotated at about 1000 r.p.m.) that effects joint in about 1 sec.; previous methods involved heated wires with other materials.

PHOTO, HANKSCRAFT CO.

Automotive

Primary evaluation at the present time is as a replacement for nylon parts. In most cases, since shrinkage factors are similar, no significant mold changes are necessary. It would also appear that polypropylene may compete with the cellulosics and polystyrenes, provided, of course, that low temperature brittleness and surface hardness are not major problems. Applications under development or evaluation: electrical connectors, terminal blocks, fuse blocks, steering wheels, armrests, knobs, horn projectors, lamp sockets, reflectors, etc. It is expected that average consumption of molded polypropylene parts per car may reach 2 to 3 lb. by 1962.

LARGE-SIZE OBJECTS WITH

After several years of successful applications in Europe, Engel process makes its American debut. Here's how it works, where it is expected to find most extensive usage

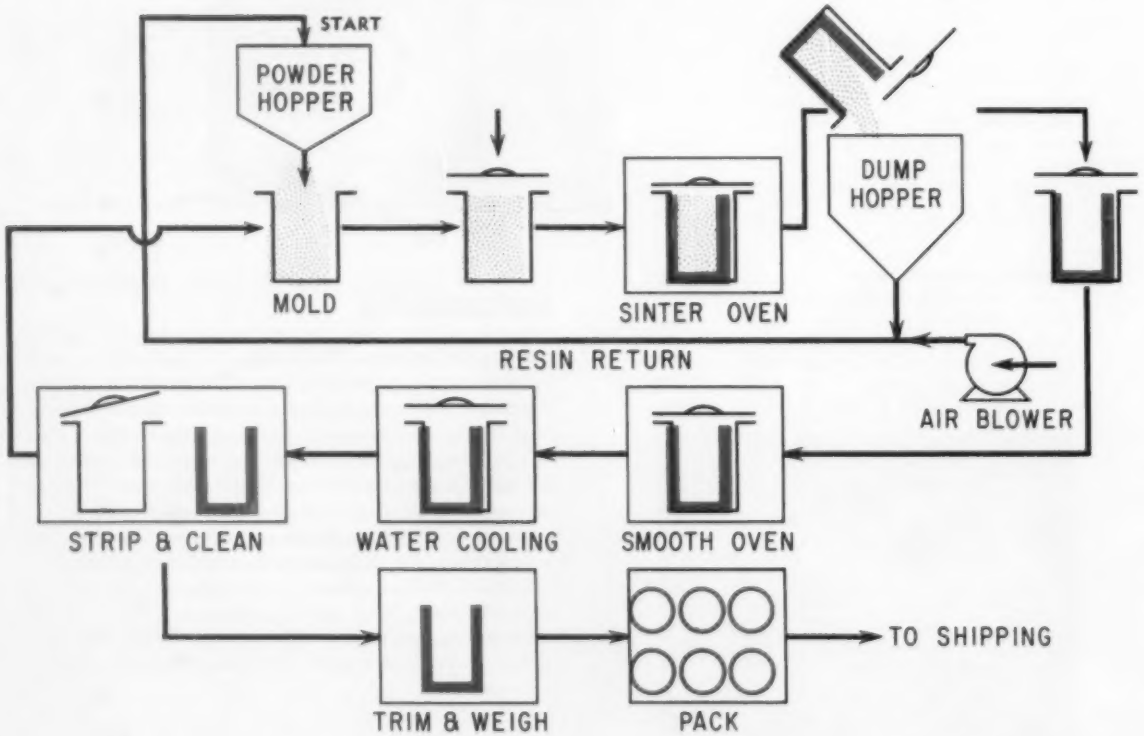
New U. S. markets for polyethylene (and possibly other thermoplastics) are in prospect with the introduction of the Engel process to this country. This process, already used successfully in Europe, makes possible the production of medium-size to very large items without expensive tooling and presses.

Invented by Thomas Engel, the process is patented in many countries, including the United States, where a basic patent was recently issued. Exclusive licensing rights in this country have just been acquired by Spencer Chemical Co. from Vaessen-Schoemaker Holding N. V., Deventer, Holland. Spencer is now in the process of licensing a limited number of U. S. fabricators to employ the process.

The only material used in current European production is polyethylene (both high- and low-density); but experimental and development work with nylon, polypropylene, and butyrate is being conducted.

Spencer's acquisition of rights to the process constitutes a market building activity. The company will license the process and sell the powdered resins used, but does not intend to use the process commercially. Spencer anticipates that the new technique will bring polyethylene to applications which, because of a

STEP-BY-STEP FLOW DIAGRAM OF ENGEL PROCESS



LOW-COST TOOLING

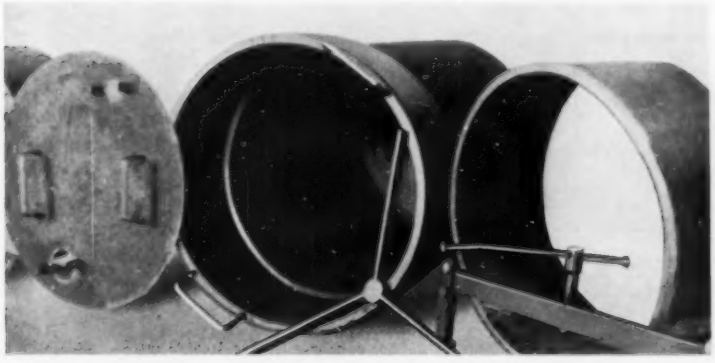
10-FOOT pleasure boat produced by Bakelittfabrikken A/S, Oslo, Norway, of polyethylene using the Engel process. Competitive with aluminum and reinforced polyester boats, the craft incorporates design features not easily obtained with other available processes.

lack of practical production techniques, have resisted penetration.

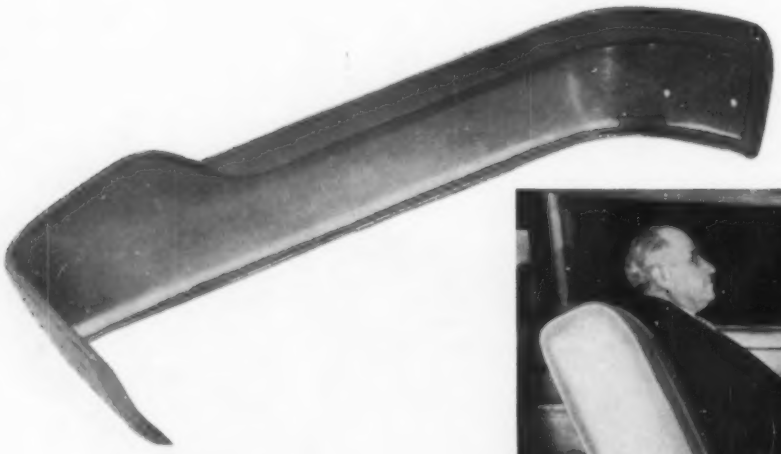
Because the process is particularly suited to the manufacture of large items, resin volume involved in these new applications may be substantial. Spencer plans to work closely with its licensees to establish such new markets, and currently has under construction at its Orange, Texas polyethylene works a pilot plant which will be used to: a) demonstrate the process; b) support product and market development; c) develop improved process techniques; and d) assist in developing specially tailored resins.

Grinding facilities are now being installed at the Orange works to make a wide range of powdered thermoplastics available to commercial users of the process. **(To page 181)**

MILK CAN, Engel-produced in aluminum pigmented PE with a natural PE liner, is made by Bakelittfabrikken, Oslo. Capacity is about 10 gallons.



MOLD USED to make 55-gal. drum by Engel process. At left is lid, which is placed on mold when it goes into oven; to the right of it is the mold itself, then the liner which fits into the upper section of the mold, resting on rim visible in photo. Apparatus pictured in the foreground is used for positioning and hoisting of the mold assembly.



POLYETHYLENE side shields installed around front seat of car. Close-ups in color show front (below) and rear view of the molded shields.

Ford goes to PE side shields

Marking the first large-scale use of high-density polyethylene in the U. S. automotive field, injection molded front seat side shields introduced by Ford Motor Co. on its 1960 models are now in full production, with five sets of two-cavity molds running in four separate molding plants. At least two other automotive manufacturers are investigating similar plastic components for some of their future models.

The seat panels satisfy three basic criteria used by Ford in evaluating all new parts. They are lower in cost than the parts they replace (painted, stamped sheet steel panels), lighter in weight, and they provide superior performance, as verified by extensive experimental testing and actual service in the field.

Use of the linear PE seat side shields will save Ford a substantial amount in production costs during the 1960 model year. Since automotive producers are ever on the alert for savings of even a few cents per car, it is reasonable to speculate that injection molded PE seat side panels may become as standard in the industry as acrylic tail lamp lenses and butyrate steering wheels.

Only 2/3 the cost of comparable steel part

Ford engineers state that the new side panels —U-shaped parts which wrap around each end of the front seat and conceal the seat track mechanism—cost only about two-thirds as much as the comparable painted steel parts. The plastic shields are complete, ready for installation, upon removal from the mold, where-

as metal units require a series of stamping operations and must be cleaned, primed, and painted. Tooling costs are, likewise, in approximately the same proportion—only two-thirds as much as stamping dies for metal panels would have run.

The plastic panels, weighing only 1 lb. per pair, make possible a weight saving of 2.8 lb. per car. Styling advantages were also gained in switching from metal to plastic for this application; with the injection molding process, Ford obtained an attractive, scuff-resistant morocco graining for the exterior surface of the panel, set off by a smooth upper portion accented by vertical grooves in crisp, sharp relief.

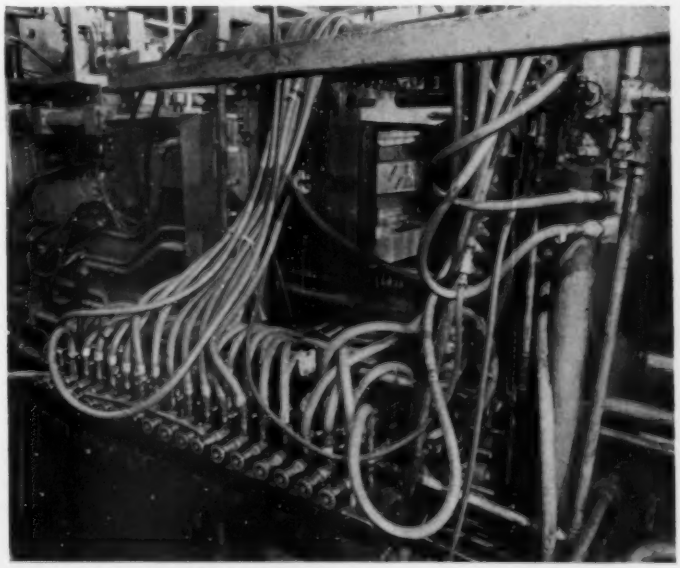
The new linear PE seat side shields were developed by the Special Projects Department of Ford's Advanced Car Engineering group, which works with all types of materials and concentrates on new applications meeting the three criteria mentioned above. Actual production of the panels, which started last fall, followed a 10-month development program, which included a study of fabrication techniques and their relation to design and styling concepts.

A major factor behind Ford's decision to investigate the possible use of plastics for these components was the desire to avoid the frailty of a painted steel surface. Because of the integral graining and color of the plastic panels, which are produced in eight colors keyed to car interior treatments, finishing operations were eliminated and the problem of damaging an applied color no longer exists. And unlike metal components, the linear PE shields, with their low thermal conductivity, do not become unpleasantly hot or cold to the touch.

Many types of plastics were tested by Ford engineers. At present, the two linear PE materials being used by Ford and the three outside custom molders producing the parts are Phillips Chemical Co.'s Marlex and Celanese Corp.'s Fortiflex. Ford states, however, that at a later date material from additional suppliers may be used for this application.

For preliminary physical and chemical tests,

Switch from steel brings one-third reduction in part and tooling costs, 2.8-lb. weight saving per car, and superior performance as well



VIEW FROM BACK OF PRESS, showing set-up for mold temperature control through restricted water flow arrangement. Water is supplied from deep well and is not recirculated.

SIDE SHIELD is removed from two-cavity mold running in 32-oz. injection molding machine equipped for sequential impact molding.

OPERATOR trims molded side shields and nests them in boxes preparatory to shipping. In foreground is shield with sprue still in place.

first parts were made by vacuum forming embossed linear PE sheet stock over plaster forms taken from the 1959 metal production side shields. Parts fabricated in this manner, made in various colors, were tested for strength, scuff resistance, and color stability. While vacuum forming proved excellent for producing prototype parts for study, it was not considered for production. With the quantities involved, it was decided that injection molding was cheaper and offered greater styling flexibility.

Procurement of a single cavity experimental mold, made within seven weeks under an accelerated program, enabled Ford engineers to make prototype production test samples and to investigate the best methods of gating and cooling so that these features could be incorporated in the production molds now running. Because of uncertainties regarding the relatively new plastic material, the 1960 side shields were carried on as a dual program for several months —one in linear PE, the other in stamped, painted steel—with the plastic shields ultimately specified for 1960 production.

A variety of performance tests pointed up the superiority of the plastic shields over their metal counterparts. A 100,000-cycle fatigue test, using a steel production seat side shield on the right side and the proposed plastic unit on the left, showed that the plastic shield caused less abrasion to the seat fabric and did not "squeak" in rubbing against the upholstery. In this test, the seat is alternately depressed and released, causing the sides of the cushion to rub against the shields.

Impact tests were also considered vital because, in entering or alighting from a car, occupants will often strike the side shields with their feet. To study how the plastic units would endure this treatment, impact tests were conducted at low temperatures with the side shield attached to seat cushion and frame. Before testing, the complete unit was held at a temperature of —20° F. for 24 hours. Then a 15-ft./lb. impact test was run.

This impact loading did not produce a failure or even appreciably dent the plastic side shield. Further testing was then conducted under the same conditions with a 30-ft./lb. impact. Repeated three times, each in a different location on the sample, this relatively heavy impact produced no failures on good molded parts. As compared to the metal shields, which were noticeably dented by impact tests in the —20 to 200° F. temperature range, the PE parts showed essentially no dent marks. Dimensional stability test results provided a value of only 0.021 in. per inch, or well within allowable limits for this application.

Developing proper gating

The single cavity test mold included a stationary front plate forming the base of the mold and three moving sections which comprised the core. Ramp type cams directed the individual sections together to close the mold. Originally, this mold was made with six gates to insure rapid filling and to minimize warpage. Parts from this mold successfully passed the performance tests mentioned earlier.

Since it was felt that the six-gate arrangement was too cumbersome to be used in production, tests were run with the experimental mold to simplify gating. The mold was successively modified by eliminating gates farther from the center of the part until final test pieces were molded with a single gate, located slightly back of the center of the part on the lower edge.

First parts made with a single gate were brittle and would not pass the impact test at room temperature. After changing to a modified tab-type gate having a section at the edge of the shield approximately equal to the thick-

ness of the part, improved pieces were obtained; but they were not as good as those made with the six-gate arrangement. Additional cooling supplied to the gate area then apparently relieved gate stresses and improved the flow pattern, resulting in parts equal in impact resistance to the original shields. Other minor changes have also been incorporated in the two-cavity molds (left and right shields) being used for production. All these molds are of the single gated type.

It was found that the extensive use of the morocco graining treatment masked the parting line on the exterior surface, making it possible to simplify mold construction by including two outside parting lines instead of a single line at the rear wrap. This feature has been incorporated in the production molds.

During production of the sample test pieces, it was decided that high-density PE with a minimum specific gravity of 0.959 would be used, with a melt index range of 2.2 to 3.7. This index range, according to Ford engineers, represents a compromise between required impact strength and ease of molding. To insure oxidation stability and color fastness, materials containing 0.02% anti-oxidant, 0.25% ultraviolet stabilizer is specified.

How the parts are molded

Accompanying production photos show molding of the seat side shields at Ford's injection plant in Brooklyn, Mich. Ford is currently running one two-cavity mold in this plant, using a 32 oz. HPM injection machine, and is readying a second mold to be placed in production within the next few months.

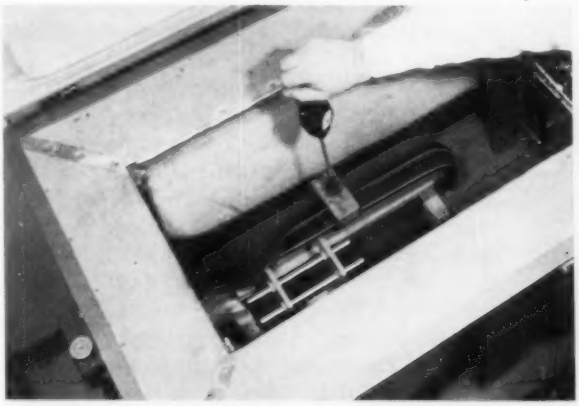
Custom molders who are also producing the seat shields for Ford include J. P. Gits Molding Corp., Chicago, Ill.; Michigan Panelyte Molded Plastics, Dexter, Mich.; and United Plastic Industries, Vassar, Mich. All of the molders are using two-cavity molds, running on injection machines ranging in capacity from 16 to 32 oz. with pre-plasticators.

The Ford production mold, of the hot runner type, is equipped with the sequential impact molding system developed by Bopp-Decker Plastics Inc., Clawson, Mich. Under this patented valve gating system, the two cavities are filled in sequence rather than simultaneously. At the end of the molding cycle, which runs approximately 50 sec., the operator removes the parts from the mold, visually inspects them, trims off the sprues and nests the parts in corrugated boxes for shipment to assembly plants. No cooling fixtures are used. Sprues and runners are reground directly at the press.

The core half of the Ford two-cavity production mold has a wedge type cam and two movable sections which are cammed into the center. Core pins located both in the cavity and core produce the two holes at each end of the shield through which it is mounted to the seat frame with thread cutting screws. The mold is liberally cored for cooling water circulation and mold temperature is maintained by means of restricted water flow, using water from the plant's own deep well system. No special mold temperature equipment is involved and water is not recirculated.

In the Ford Brooklyn molding plant, raw material is fed from the first floor level, where all material storage is concentrated, to the injection machines by means of air pressure, using a Whitlock Tornado loading system which is employed throughout the plant. On the seat side shield molding job, the linear polyethylene material is delivered more than 100 ft. from supply drums to the injection molding machine by this system. Ford produces the shields in both blue and beige; each of the three custom plants is also running the parts in these two colors.

The company's successful program with linear PE seat side shields, grounded in sound economics and satisfactory field performance, is expected to stimulate interest in other interior and trim applications of the material in the automotive field.—End



IN TEST RUN to determine acceptability of new Ford side shields, parts were exposed to temperatures of —20° F. and then given deflection tests to determine breakage point. Instrument used by technician measures amount of deflection. Panels passed tests with flying colors.

Variety in core materials, skins, and production methods lends application and market versatility to

SANDWICH STRUCTURES

With the burgeoning interest in plastics as structural components, considerable attention is being focused these days on the design and economic potential of plastics sandwiches.

And no wonder. Many of the most desirable properties designers and engineers like to specify—translucency, high strength-to-weight ratios, corrosion resistance, thermal and acoustical insulation, inherent color, simplified construction and assembly—can be provided by plastics sandwiches . . . and often at a saving in cost as well.

Growing usage has been recorded in such markets as transportation, appliances, interior decor, building construction, aircraft and missiles, and other fields. Using a variety of skin and core materials, manufacturers of sandwich structures have made available a wide choice of panels to meet specific requirements.

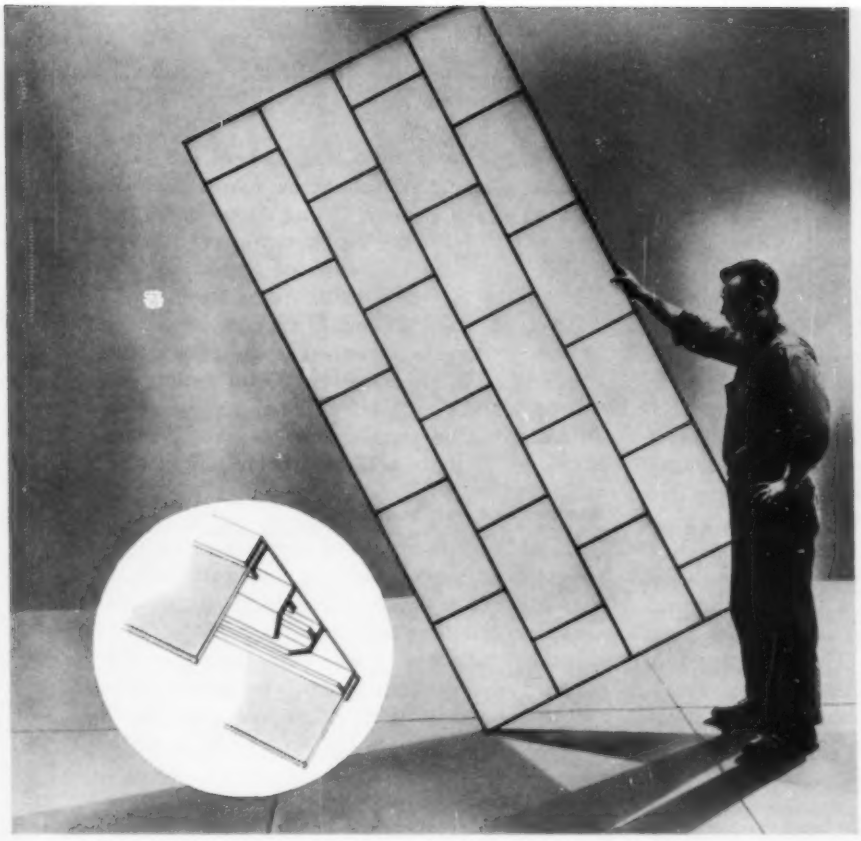
Building panels

Unquestionably, the largest outlet for plastic sandwich constructions will be in the building field. Some idea of the potential may be gained from the fact that the average home today contains approximately 10,000 board ft. of lumber, including from 1000 to 3000 separate pieces. One of the greatest virtues of sandwich construction lies in the elimination of hand assembly operations now involved in getting all these pieces together.

Two basic methods—with numerous variations in each—are used to produce sandwich panels. One consists of bonding reinforced skins to some type of pre-fabricated core. The core may be composed of plastic, impregnated paper, or metal honeycomb cells, a slab of balsa wood, foamed plastic, or other materials. Attachment of the fact sheets is thus a secondary operation, following preparation of the core. The other, of more recent origin, involves a suitable lightweight core material, such as urethane or expandable styrene foam, foamed *in situ* between the face sheets.

For the past five years, the American Bridge Div. of U. S. Steel Corp. has conducted an extensive test program on curtain wall construction, using 2 lb./cu. ft. urethane foam and 22-gage sheet steel. Results showed that the panels were as flat as when installed, the core was dry, and its fire retardancy unchanged. Adhesion, tensile, and shear strength tests were termed "most encouraging."

One of the most active programs involving expandable styrene core sandwich panels has been spearheaded by Koppers Co. Inc. A Kop-



JAI ALAI fronton (far left) at Daytona Beach, Fla., has 10,000-sq.-ft. reinforced plastics sandwich facade made of translucent Sanpan panels produced by Panel Structures Inc. A single panel is shown at left. Integral aluminum lip (see inset) protects RP skins.

pers plant in Detroit, Mich. went into commercial production of such panels in December, 1959. In addition, several companies—including National Gypsum Co., Buffalo, N. Y., and Masonite Corp., Chicago, Ill.—have been licensed to produce the Dylite modular panels.

These panels are incorporated in the two-story 1959 NAHB research house recently built in E. Lansing, Mich. Of particular interest was the plumbing core wall, which was fabricated complete with framing and pipe and trucked to the job site. Building code approval for the panel system has been granted in Detroit, where 40 homes have been erected using the Dylite panels as interior partitions.

In load-bearing capacity, the Dylite panels exceed the standards that have been established by the Housing and Home Finance Agency for walls of conventional construction. Their light weight also permits ease and speed of handling which will appreciably reduce labor costs. The panels' excellent insulation value results in a substantial reduction in utility costs.

In Monsanto Chemical Co.'s new Inorganic Research Laboratory building, built in St. Louis, Mo. about two years ago, sandwich panels consisting of two outside plastic sheets over a 2-in.-thick styrene foam core were used extensively. The entrance canopy of the building includes a translucent section of aluminum honeycomb faced with glass reinforced poly-

SECTION of brick-finish, foam-core load bearing panel wall, made by Koppers Co. Inc., is raised into position at front of 1959 NAHB Research House, East Lansing, Mich.

ester material. The sandwich type curtain walls were used in conjunction with plastic faced concrete blocks and acrylic windows for a distinctive, modern architectural treatment.

Cost of the aluminum framing with plastic sandwich panels ran $6.67 per sq. ft. on the Monsanto laboratory building, as compared to $6.72 for a comparable alternate construction—aluminum framing with porcelain enamel faced panels having a 2-in. layer of glass fiber insulation between them. The saving in this instance was largely effected in labor: the plastic sandwich units weighed only 76 lb. each compared to approximately 600 lb. for the steel panels used on another Monsanto building.

A more recent application of panels with RP skins and aluminum core is the new Sunoco Service station on U. S. Route 13, one mile south of Bridgeville, Del. The resin used is Du Pont's Lucite acrylic. This modular panelized building system is estimated to save owners $350 to $600 each year in painting costs.

Appliances

Foam-core sandwiches also have a promising potential in refrigeration and related fields. Westinghouse Electric Corp. in recent years has done a great deal of development work with all-plastic and part-plastic sandwich panels in a new approach to refrigerator construction that provides important cost savings. Earlier projects involved panels having an expanded styrene core bonded to impact styrene sheet faces; more recently, two pilot models were introduced in which the sandwich employed anodized aluminum faces.

In both instances, the technique involved cutting and mitering a long slab of the sandwich material so it could be folded and cemented at the corners (using epoxy-based adhesives) to form the top, bottom, and sides of a cabinet having built-in foam insulation. Another piece of the material forms the back of the refrigerator. An important cost advantage of this construction method is the fact that it eliminates the necessity for costly tooling required in building conventional refrigerators. In addition, the panels' light weight saves as much as 120 lb. in a 12-cu.-ft. refrigerator.

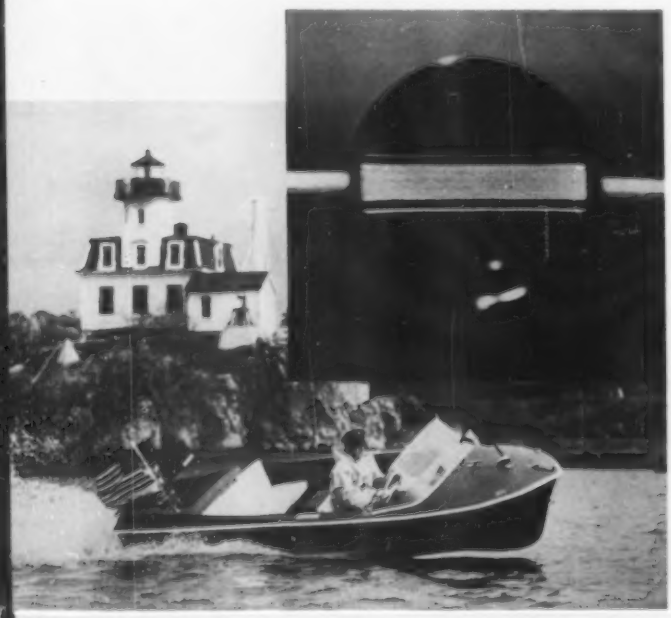
Sandwiches for boats

In addition to urethane and expanded styrene, other types of plastic foams which may be used as cores in sandwich constructions include phenolic, cellulose acetate, polyethylene, vinyl chloride, silicone, urea formaldehyde, and epoxy. Considerations of cost, end use requirements and fabrication techniques are among the factors controlling the type to be used in each instance.

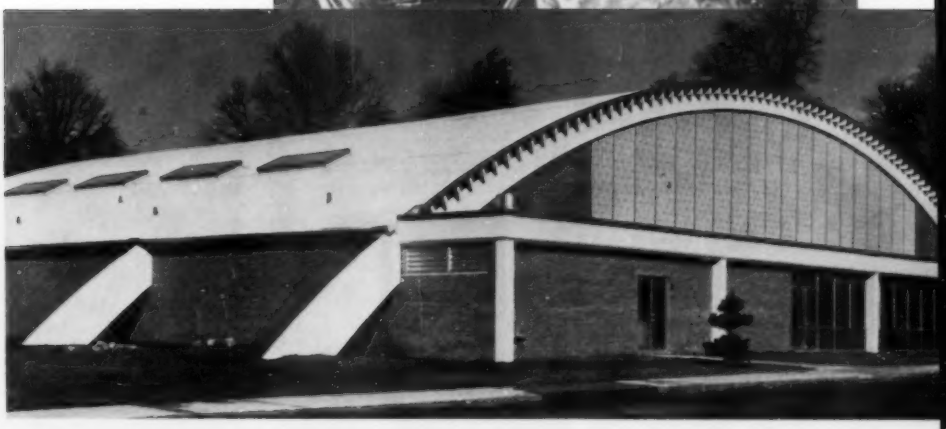
A somewhat different construction gaining increased interest in the small boat field consists of expanded Royalite ABS core with a ply of hard Royalite bonded to each side. Produced by U. S. Rubber Co. and formed into boat components at the company's Providence, R. I. plant, this material combines extreme toughness with built-in flotation, thermal insulation, and sound deadening properties.

U. S. Rubber produces expanded Royalite hulls, decks and other components for such firms as Thompson Royal-craft Inc., Cortland, N. Y., and Carter Craft Corp., Panama City, Fla., which manufacture the finished boats. In forming the hulls, a flat sheet of the sandwich material is heated to several hundred degrees Fahrenheit while supported in a rigid rectangular framework. A male plug is then brought against the softened stock, forming the part by means of a hot drawing operation. Even wooden molds with a glass fiber laminate covering may be used in producing parts by this process.

Balsa wood is another material frequently used as a core in the manufacture of reinforced plastic boat hulls. Here its stiffness, light weight, and flotation properties (it will support over 50 lb. deadweight per cu. ft.) upgrade the



HULL of 14-ft. runabout is made from sandwich consisting of expanded Royalite acrylonitrile-butadiene-styrene (ABS) material used as the core and Royalite ABS sheet for faces. Inset shows cross-section of hull.



GLARE-FREE natural light is provided by Iselin Junior High School gymnasium through use of Kalwall panel unit system installed on ends of concrete arched structure. Skylights on roof are made of a similar construction, also by Kalwall.

finished hull. Balsa boat stock, used in hulls, decks, coamings, canopies, seats, and other components, is supplied in a variety of thicknesses, cut to finished size to eliminate excess labor and waste.

Balsa Ecuador Lumber Corp., a major supplier of this material, describes it as the highest strength/weight ratio core material available, with a modulus of elasticity along the grain of 750,000 p.s.i. and a shear modulus of rigidity averaging 20,000 p.s.i.

For decorative effects

When light transmission is one of the properties desired in the sandwich, cores of various designs are used with plastics faced sheets that permit the passage of light in controlled amounts. Cores made of resin-impregnated kraft paper, fibrous glass laminate, wood, and other materials, are rapidly gaining acceptance among architects and builders.

Panel Structures Inc., East Orange, N. J., produces decorative structural sandwich panels under the name of Sanpan. The units are assembled from fibrous glass-reinforced polyester skins bonded to extruded aluminum frames and internal grids. Rigid, shatterproof, and light in weight (1½ lb. per sq. ft.), the panels are adaptable for numerous interior and exterior architectural and decorative treatments. Their insulating qualities exceed those of glass block or double-glazed windows.

One of the largest installations of the Sanpan panels is in a new Jai Alai fronton or arena erected in 1959 in Daytona Beach, Fla. The facade of this building, seven stories high, incorporated approximately 300 4- by 8-ft. Sanpan panels in translucent banks of red, white, and blue. Interior lighting through the diffusing panels can be seen as far as half a mile away, eliminating the need for external spotlighting of any kind.

A different combination of materials is employed by Monostructure Inc., Sarasota, Fla. Its Panelux line incorporates cellular cores made of water resistant phenolic impregnated kraft stock, in combination with fibrous glass-polyester face sheets.

The line includes both panels and doors, made by a special Monostructure-developed process producing a deeply fused bond so that the core is virtually integral with the facings. Glass reinforcement materials used in the construction of these products are supplied by Owens-Corning Fiberglas Corp., with polyester resins from American Cyanamid Co.

Tropical sandwich panels, produced by Russell Reinforced Plastics Corp., Lindenhurst, N. Y., and Boca Raton, Fla., and distributed by Naugatuck Chemical Div., U. S. Rubber Co., through approximately 30 architectural supply firms, are available in a variety of patterns for residential, hotel, school, and other types of installations. Translucent, colorful, and decora-

DECORATIVE DOORS, made of Panelux sandwich produced by Monostructure Inc., have colored inserts in some of cells to add interest. Installation is between dining area and kitchen of Florida restaurant, where door takes lot of abuse.

tive, the Tropicel panels (see MPI, Sept. 1959, p. 88, for details) may be used as interior walls and partitions, dropped ceilings, curtain walls, room dividers and screens, patio roofs, and many other applications.

Kalwall Corp., Manchester, N. H., panels consist of polyester-glass fiber faces bonded to extruded aluminum I-beam cores assembled with a mechanical locking system. The standard 8- by 20-in. grid pattern has recently been supplemented by a new random grid core. Facing materials, purchased from several leading sheet suppliers, weigh approximately 8 oz. per sq. ft. in the standard 0.060-in. thickness. They are bonded to the core under heat and pressure with resin type adhesives, developing a bond of over 400 p.s.i. under dynamic tension.

One of the most notable Kalwall panel installations was in the roof of the U. S. Pavilion at the 1958 Brussels World's Fair, embodying 72,000 sq. ft of the translucent units. Architects estimate that in the newest addition to the Stamford, Conn. senior high school, the translucent Kalwall panels will provide at least a 75% reduction in heat loss as against equal areas of glass.

The building will have external walls constructed of translucent Kalwall panels, opaque spandrel columns made with a balsa wood core, and fixed and operable sash sealed into light weight, structural, 3½- by 10-ft. panel units. The structure uses a system of interconnected structural components, forming rigid modular units replacing the customary heavy mullions and floating panels used in conventional curtain walls. Using this system, four men can install 100 yd. of wall in 4 days.

A major West Coast supplier of sandwich panels incorporating a complete range of core and face materials is Architectural Plastics Corp., with headquarters at Eugene, Ore. Typical core materials range from fiber honeycomb and expanded styrene to various other expanded plastics, including rigid phenolic, epoxy, urethane, and vinyl. Among the face materials used by APC are reinforced plastics, vinyl-clad aluminum or steel, porcelain-steel, anodized aluminum, stainless steel, plywood, hardboard, high strength laminated papers, and cement asbestos board.

NIKE ground radar housing, about 20 ft. long, uses ¼-in. Hexcel aluminum honeycomb on one side, nylon-phenolic honeycomb on the other. Exterior skins are glass reinforced polyester, and the entire assembly is produced by Brunswick-Balke-Collender Co.

SOLID ADHESIVE, Metlbond 406, produced by Narmco, is easily handled. Under heat, material flows and cures into tough, high-strength film for sandwich structures using bonded skins.

Aircraft and missiles

Companies working with sandwich constructions in the aircraft and missile fields encounter many specialized problems. Highly engineered constructions used in these fields are a major activity of Zenith Plastics Co., Gardena, Calif., which is a subsidiary of the Minnesota Mining and Mfg. Co.

A vacuum bag molded sandwich with void free glass fiber-epoxy skins and phenolic honeycomb core is a typical construction. Cure of this sandwich requires 7 hr. at 275° F.

Another Zenith construction is a "loaded core" epoxy sandwich used in the half-wave type of radome, defined as "a dielectric wall whose thickness is one-half wavelength in the material." In constructing such a radome, one method is to make a single (To page 184)

1952

NON-PLASTIC components of metal-housed vacuum bottle are (left, from top): metal cup; cork stopper; cork cushioning ring; metal tip protector; and metal housing cap.

1960

COMPONENTS of plastics bottle (from top): handled and handle-less nested cups; insulated stopper; pouring lip; shock absorber-tip protector; screw plug. See chart on p. 99 for details.

REDESIGN FOR TOP OF THE LINE

Long-term program of vacuum bottle manufacturer culminates in all-plastics model with many advanced design features

Among case histories of product improvement through redesign in plastics, few can match the amazing transformation of the famous Thermos vacuum bottles. Produced by The American Thermos Products Co., Norwich, Conn., and long familiar to the American public in 100% non-plastic makeup, the bottle has now emerged in an Aristocrat model which is essentially a 100% plastic product (only the double-wall, vacuum insulated glass filler is retained). Significantly, the plastic bottle is *not* a low-cost model in an otherwise higher-priced line. On the contrary, the Thermos is a premium product that commands a premium price, and it has attained this enviable position through imaginative yet sound utilization of a variety of plastics materials.

The components of the Aristocrat bottle are listed in the table on page 99, together with their approximate weights, the plastics materials of which they are made, and the advantages they provide. The bottle is produced in

OPERATOR removes vacuum bottle housings from 2-cavity mold in Impco machine. Pieces are molded of heat resistant impact styrene.

IMPACT styrene transition base, which is threaded to receive screw plug, is solvent cemented to bottle housing, and entire assembly then placed in clamping fixture (at right).

FROM CLAMPING FIXTURE, bottle housing with transition base is placed on rack for further room-temperature cure, the final phase of solvent cementing operation.

quart as well as pint sizes. The suggested retail price for the quart bottle is $4.95; the pint size sells for $3.40.

How design changes came about

It should be noted that the new plastic-cased bottle does not represent a sudden reversal of design policy. Gradual incorporation of plastics into the product line has been underway since 1934, and production of a vacuum bottle without a single plastic part ceased after 1952. But the final triumph of the step-by-step materials changeover is the bottle housing, which gives a completely new aspect to the traditional face of the vacuum bottle.

The design consultant, Jacques Martial of Martial & Bars Assocs., has conceived a bottle casing more rectangular than cylindrical, with four definite surfaces. Front and back surfaces are gently contoured, and side surfaces are slightly concave, with horizontally raised ribbing for greater gripping ease. This new styling is economically feasible only in a molded plastic bottle housing.

How the plastic components are produced

The injection molder of the individual bottle parts is Plastene Corp., Crawfordsville, Ind., a subsidiary of American Thermos Products. Both vacuum bottle case and transition base are produced on an 80-oz. Impco machine, in 2- and 4-cavity molds respectively. Cycle time for both is about 1 minute. Subsequent to molding, the bottle case is hot stamped with the Thermos trademark and joined to the transition base by a solvent cementing operation.

The combination tip protector and shock absorber is molded in 24 cavities on a 16-oz. Watson-Stillman machine, with a cycle time of 30 seconds. It is bonded to the glass filler by a hot melt, polyester-based adhesive, formulated specifically for this application by Raybestos-Manhattan Inc., Manheim, Pa. An extruder of the manufacturer's own design deposits twin jets of the adhesive in a circular pattern on the shock absorber.

A four-cavity mold on a 12-oz. Reed-Prentice machine produces the screw plug, and the cycle time is approximately 40 seconds. The insulated stopper and its cap are molded on either a 12-oz. Impco or the Reed-Prentice machine mentioned above, using 16- and 24-cavity molds respectively. The 16-oz. Watson-Stillman is used for the pouring lip, which is molded in 24 cavities on an approximately 30-sec. cycle.

The handled cup for the quart bottle is

molded in six cavities on a 32-oz. Watson-Stillman, with a cycle time of about 45 seconds. The smaller handled cup for the pint bottle is molded in eight cavities on a 16-oz. Watson-Stillman, with an approximate 32-sec. cycle. Handle-less nested cups for the quart bottle are produced on either the 12-oz. Impco or Reed-Prentice machine, in a six-cavity mold with a cycle time of 32 seconds.

To the plastics industry, the significance of this product development is clear: traditional concepts of product design, though they may have stood the test of time, can often be remarkably bettered by the proper choice and imaginative use of newer materials. And certainly the plastics industry has a wealth of such materials.—End

SPECIALLY FORMULATED polyester-based adhesive bonds PE tip protector-shock absorber to glass filler bottle. Adhesive is extruded by twin jets in a circular pattern on the plastic part.

PLASTICS COMPONENTS OF ARISTOCRAT VACUUM BOTTLE

Component	Approx. weight (oz.)	Material	Supplier	Advantages
Bottle casing	11⅓	440-M high heat resistant/impact styrene	The Dow Chemical Co.	Replaces metal housing. Permits contoured styling not economical with metal. Four-sided design prevents rolling, slipping. Cannot dent or rust. Molded in color cannot peel or chip.
Transition base	1½	VH-387 impact styrene	Foster Grant Co.	New part. Threaded to receive screw plug. Excellent impact-resistant properties, will not swell or warp.
Screw plug	1	Marlex 6000-Type 50 high-density PE	Phillips Chemical Co.	New part. Serves same functions as metal collar located at top of old bottle. Easily removed for access to glass filler. Strength adds to shock absorbing qualities of tip protector/shock absorber. Offers resistance to galling, flexing, and distortion.
Pouring lip	¼	DYNH medium-density PE	Union Carbide Plastics Co.	Replaces glass pouring rim. Prevents dripping, is unbreakable and sanitary.
Insulated stopper and cap	½			Replaces cork (although stopper contains small cork filler). Does not swell or pick up content odor.
Tip protector/ shock absorber	1	Marlex 5000-Type 50, or Fortiflex B-5250 high-density PE	Phillips Chemical Co., Celanese Plastics Corp.	New part. Fits snugly against closed end of glass filler to protect exhaust tip, absorb impact and cushion filler against breakage.
Handled cup	1¾	VH-387 impact styrene	Foster Grant Co.	Replace metal cups. Offer high insulating properties. Easy to clean. Do not dent.
Nested cups—2 (quart only)	1 each			

Plastics in the product revolution:

When one studies the development of the modern electric food mixer, it seems almost inevitable, in retrospect, that sound design engineering—no matter what course it took along the way—would eventually have lead to the present-day volume usage of plastics materials.

Back in the 1930's, the newly-introduced food mixers that were then selling at the rate of about one-half million units a year were heavy, stand-up affairs driven by powerful motors—and with little room for plastics. Most of the housings and internal parts were die cast aluminum or zinc engineered to withstand the weight and vibration of the motor. Westinghouse Electric Corp., one of the pioneers in the field, recalls that its 1935 models had only two plastics parts of consequence: a molded phenolic handle attached to the metal housing and some switch parts fabricated of high-pressure laminate materials.

LIGHT WEIGHT required for portable electric mixers has opened the door for plastics to be used in mixer housing construction.

Photo, General Electric Co.

By 1950, stand-up electric food mixers had reached a sales peak of 1,700,000. But although some producers were marketing mixers with housings molded of urea or melamine, most of them clung stubbornly to the design concept of a metal body and a plastic handle.

In that year, however, a product innovation took place that was destined within the next decade to completely change the picture. The product: the portable electric food mixer. Designed for lighter kitchen duty, the portables used a less powerful motor than the stand-ups, were built to keep weight to a minimum, and almost from the very beginning were a prime market for plastics materials.

Heat resistance important

Because of the need for Underwriters Laboratories' approval, emphasis in those days was on the thermoset materials, primarily urea and melamine, and in the early 1950's both materials fought it out with aluminum for a share of the lucrative mixer housings market. By the late 1950's, as plastics took over more and more of the market, there was a noticeable switch on the part of several major manufacturers from the thermosets to injection molded housings of flame-resistant cellulose acetate (other manufacturers, however, still use the thermosets). Within the same time period, handles molded of new heat-resistant styrene copolymers started to encroach on that share of the portable mixer market that was traditionally held by the phenolics.

And while the amount of plastics used per mixer increased, the over-all market for portable mixers surged upward at a phenomenal rate. As the introduction of ready-mixes encouraged the housewife to change her cake-making habits, the sale of portables (which, despite their light-weight motor, can easily handle the ready-mixes) shot upwards from 145,000 units in 1950 to 2,400,000 units in 1957.

The one-piece housing

Now, within the past two years, plastics have made still another—and probably their most important—advance in mixer design and engi-

ELECTRIC MIXERS

THE COVER: Sound engineering use of plastics materials has guided the path of electric food mixers from the cumbersome egg beaters of yesterday (background) to the streamlined models that are currently in use.

In the hands of the design engineers responsible for today's 2¼ million portables, plastics have created entirely new concepts of styling and construction

neering. The new concept, which has pushed the use of plastics up to the point where it now represents 20% of the total weight of the average mixer, is the one-piece molded housing and handle. Since plastics offer superior appearance in terms of finish and color, since they are lighter in weight than metal (they weigh only half as much as aluminum), and since they can be designed to eliminate many subsidiary mounting and finishing operations, the switch to the one-piece housing-handle can mean important savings (in one reported case, a 10% cut in costs) and important merchandising and styling advantages to the manufacturers of electric mixers.

In one instance, that of General Electric's new portable model (see photo, left), the one-piece housing was designed to replace a four-part assembly: a painted die cast cover, two chrome-plated die cast grilles, and a painted phenolic handle. For another manufacturer, Westinghouse Electric Corp., the one-piece housing (see cover photo) replaced a two-part assembly in which a styrene handle had to be screwed into a die cast aluminum cover and then put through costly finishing and painting operations. Both of these housings (acetate is used in both cases) were designed to fit over a metal plate (containing bearing supports and gears) on which the motor is mounted. In this way, design engineers found it possible to eliminate the complexities associated with assembling the motor, motor end bells, gear boxes, etc.

Although most other mixer suppliers seem to be moving in this same general design direction, it is interesting to note that one manufacturer has on the market a unit in which both the top and bottom half of the housing are molded of melamine, while the motor is mounted in a skeleton die casting fit into the lower half.

While the housing-handles represent the largest volume use of plastics in the mixer field (both the G.E. and Westinghouse cases weigh about ½ lb. each), other applications cannot be overlooked. Westinghouse, for example, reports that in addition to the acetate case, the following plastics parts are used in its new mixers: a beater ejector and a switch knob molded of styrene copolymer (since steel pin inserts are molded into the ejector, dimensional stability was of paramount importance in this selection); a set of molded nylon gears pressed onto a shaft; a molded urea plug-in receptacle; and a switchplate and brush holder fabricated of a phenolic laminate. In the GE model, some of the additional plastics parts include: a vinyl gasket running around the base of the mixer to serve as a soft cushion or bumper, molded phenolic brush boxes (chosen for its electrical insulation properties), and a molded polyethylene ejector release button.

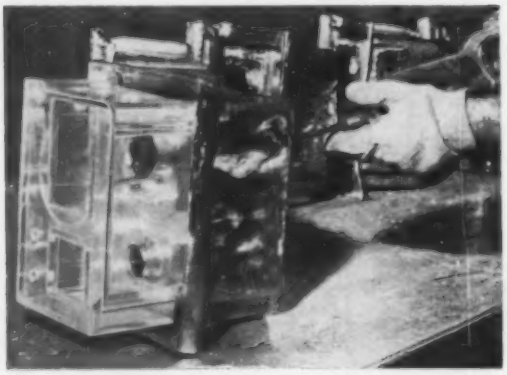
What the future will bring for electric food mixers and plastics usage is difficult to guess. Certainly, the volume of sales will continue at a steady pace. In 1959, the portable mixers hit a figure of 2,250,000 and the stand-up mixers stayed in the picture with sales of 925,000 units. Design-wise, it seems logical to assume that the molded one-piece housing will take much of the play away from metal. It is interesting to note, too, that several manufacturers have been toying with the idea of providing stands for the portable mixers so that they can do double-duty in the modern kitchen; more interesting still is the fact that a prominent appearance in the list of possible materials to be used in the construction of the stand was made by—you guessed it—plastics.—End

#19, #20 in a series

EVERYBODY NEEDS EPOXIES

BLEND OF crystal clear epoxy resin and hardener is carefully poured into mold in order to make bubble-free castings.

TRANSPARENT CASTING, fully hardened, is easily separated from the mold, which was first pretreated with a release agent.



Systems for casting

By Max Hilrich* and Benedict L. Wallis†

Growing demand for epoxy casting resins has spurred progress in special formulations which increase the number of desirable properties of these resins. There are now on the market rubber-like resins castable in a wide range of hardnesses—from the flexibility of plastisols to the toughness of hard rubber; lead-filled resins for high-density casting, especially useful as a barrier against radiation; resins that can be cast and then carved as readily as wood with standard hand tools; and resins capable of withstanding 500° F. continuously and up to 600° F. intermittently. Epoxy alloys, in which the advantages of an epoxy base are supplemented by reinforcement wtih metal fibers, are gaining interest and acceptance, particularly for mass castings and a variety of applications requiring exceptional impact strength and thermal conductivity.

Casting of epoxy resins is an inexpensive process that does not require specialized skills and can be accomplished with simple tools and small capital layout.

Epoxy casting formulations are generally two-component systems, comprised of the resin and hardener or curing agent. The resin-hardener mixture is poured into a mold-release-treated cavity and cured.

In formulating an epoxy casting material to meet the requirements involves numerous factors. Cost; viscosity; physical, thermal, and electrical requirements; exotherm; and potlife are a few of the considerations. Others involve the design and size of a particular casting, the heat resistance of a potted component, the space available for resin flow to fill a given void, the abrading properties of a metal blank to be formed on a plastic tool, etc.

The physical, electrical, and thermal properties of casting resins can be varied through the use of appropriate hardeners, fillers, flexibilizers, thickening agents, and diluents. This flexibility in formulating, in addition to the ease of processing, is largely responsible for the

*Research Director and †Chief Chemical Engineer, The Marbiette Corp., Long Island City, N. Y.

wide use of epoxy casting resins in tooling, in the electronic, the foundry, and the vacuum forming industries.

Resins cover wide range

Epoxy resins available for casting are numerous, and cover a wide range of viscosities which vary from low-molecular-weight and low-viscosity, freely flowing liquids to high-molecular-weight solids which require heating and melting. The low-viscosity resins are generally used for the formulation of casting compounds containing a great amount of filler. Although on curing the low-viscosity resins provide poorer physical properties and lower heat distortion points than the higher-molecular-weight, longer-chain resins, they are easier to work with and are widely used where heat distortion and physical characteristics are not of primary importance. Low-viscosity resins are frequently used in formulations designed for filling large voids, such as cores of large metal forming tools; in radiation shielding applications requiring high loadings of fillers; or in lightly filled casting formulations designed to pick up fine detail.

High-viscosity resins, on the other hand, are used in formulations where the resin is intended to carry the performance of the finished casting. High-heat-resistant and high-strength casting formulations will generally be based on a high-viscosity, high-molecular-weight, epoxy resin. Metal forming die faces, and some components of a draw die will use a high molecular epoxy resin for the base.

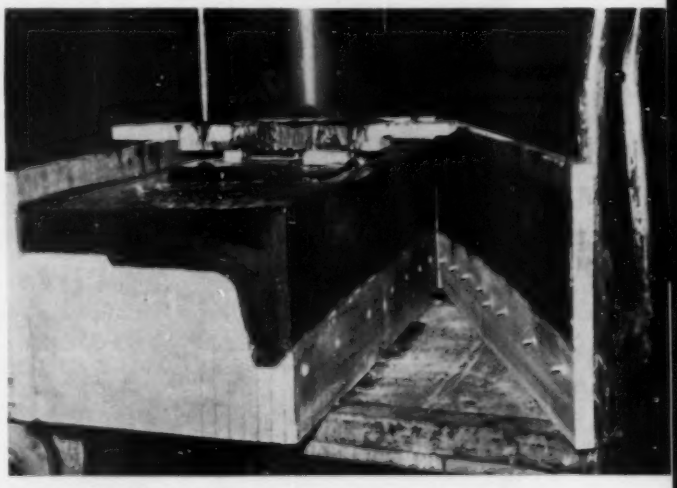
HAND HAMMER FORMS are fabricated by pouring epoxy casting resin around phenolic foam block that is suspended in the mold cavity. Form serves as core of the finished tool.

Curing agent and fillers

Hardeners or curing agents determine the success or failure of an epoxy casting formulation. Potlife, gelling time, exotherm, curing time, and heat resistance of the final cast are directly dependent on the hardener.

Fillers reduce cost, dissipate heat of reaction, increase heat conductivity, reduce shrinkage, and may influence the surface hardness of the casting, but at the expense of mechanical properties. Fillers should be neutral and non-reactive. Various forms of carbonates, silicates, and metallic and non-metallic powders are being employed. Their choice, of course, depends on the end use.

Aluminum powder is generally added to increase the thermal conductivity and impact strength of the resin, and this filler is widely used in casting resins designed for the construction of vacuum forming molds. Silicates will in-



AFTER OVERNIGHT CURE at room temperature, epoxy tool has hardened. Frame containing tool cast over plaster mold is then removed.

crease the abrasion resistance of a casting resin; and mica, powdered glass, or asbestos, for example, will improve the electrical properties. The carbonates are generally used for increasing the bulk of the resin and thus lower the cost of the formulation. Lead, polyethylene, and boron-filled epoxy casting resins are finding increasingly frequent usage as radiation shielding materials.

Flexibilizers, plasticizers, modifiers and diluents comprise a large group of materials designed to vary the properties of the final casting. Flexibilizers and plasticizers may be found in shock resistant formulations, while diluents will most likely be added for better penetration as well as for lowering the viscosity of mixes that are hard to handle.

Polysulfides are representative of the flexibilizers. The diluents like phenyl, butyl and allyl glycidyl ethers, and styrene oxide produce a plasticizing effect on the resin through dilution but with degradation of the physical properties of the end casting.

Factors in mold selection

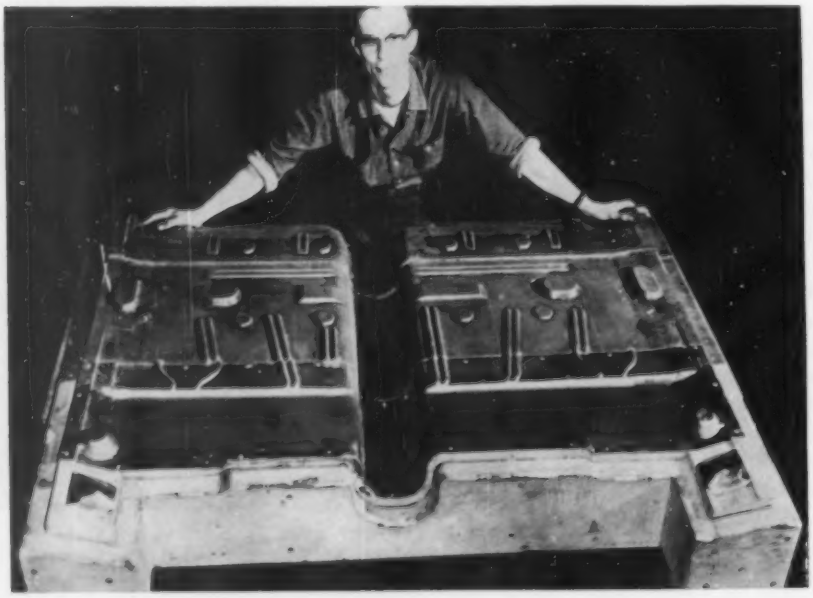
Because of the strong adhesion of epoxies to a great variety of materials, the casting of the resin presents some problems. The molds have to be treated with parting agents to assure removal of the casting from the cavity. Waxes, vinyl alcohols, silicones, polyethylene, and Teflon are most commonly employed. The parting agents are applied by brushing, wiping, slushing, or spraying.

In the basic casting procedures for plastics tools and dies, many types of molds are used, the choice depending largely on the chemical make-up of the resin and the size and contour of the casting.

A standard method begins with the casting of a plaster mold from a model. A parting agent is applied, and the liquid resin poured into the cavity. After curing, the casting is easily removed from the mold. It has a smooth surface that ordinarily requires little or no finishing before the cast tool can be put to work. Almost any rigid material that is capable of holding liquid can be used as a mold for the purpose of casting epoxy resins.

The casting process of epoxy resins provides low cost, ease of operation, short lead time, ease of making changes in design, accuracy, excellent pickup of details, as well as good physical and thermal properties. The process is particularly suitable for short runs, where its advantages and economies are self evident. When combined with some form of reinforcement, such as glass, synthetic fibers, and similar materials, cast epoxy resins provide excellent long run possibilities.—**End**

METAL-FORMING DIES, such as the one pictured here, which is used by automobile manufacturer, are cast from epoxy resins for moderately long production runs and prototype work.



Epoxies get sea legs

By Allan G. Butler*

New production techniques and reduced raw material costs have now brought epoxy resins to plastics boat building, a field once held almost exclusively by polyesters.

The first of these techniques involves a specially designed spray gun which combines epoxy resin and hardener a fraction of a second before the system is atomized and sprayed. Since there is no opportunity for the system to harden before application, the user is free to select the fastest resin system compatible with his operation.

Using this technique, a laminate is laid up on a mold by simultaneous spraying of epoxy resin and deposition of chopped glass fiber. This is followed by rolling and post cure. Equipment used is the Gusco Process line manufactured by A. Gusmer Inc., Woodbridge, N. J. The product is a boat that will resist stress cracking, corrosion, and rotting.

Disposable-mold method

Another technique, called disposable mold construction, uses an inexpensive ⅛-in. plywood mold, laid up inside and out with epoxy resin and glass cloth. If desired, only the outside of the mold need be laminated. This construction was used to fabricate a 65-ft. boat currently operating in the Gulf of Mexico as a service craft for off-shore drilling rigs. The possibility of replacing hand lay-ups by spraying is currently being investigated.

Epoxy boats can also be produced by the vacuum bag procedure. After spray-up, the mold is closed off with a flexible bag, and a vacuum is pulled on it. Rolling is minimized, as a degree of densification and air removal is accomplished by the vacuum. This technique differs from those previously detailed in that it produces a low-pressure laminate of high glass fiber content. As the bulk of the boat's strength is contributed by the glass fibers, such boats have much greater strength possibilities than those craft that have been fabricated at atmospheric pressure.

Boat from preformed sock

A further technique is designed for the do-it-yourself market. The product, called a Sock Boat,[1] is made by pulling a preformed sock over a jig or die-cut corrugated paper. The sock, saturated with resin and cured, becomes the mold. Two layers of glass fiber woven roving and resin are then applied. Upon cure, the corrugated paper is torn out, and the fixtures are finally added.

As the production of epoxy boats is a relatively new development, sufficient time has not yet elapsed to permit thorough evaluation of the various construction techniques. Existing techniques are constantly being refined, and new methods developed. Consequently, comparative evaluation of the described techniques is not attempted here.

Comparative prices, properties

Although epoxy resins are somewhat more expensive than polyester resins, they have important advantages for the boat owner. Because of greater strengths, lighter-weight boats can be made. A higher modulus of elasticity means that epoxies offer greater stiffness than polyesters, a property of particular significance in boat hull and deck construction. Epoxy laminates resist loss of strength through flexing fatigue. Crazing in resin-rich areas, a problem with polyester, does not occur with epoxy. Epoxy is also more impact absorbent, stronger, more durable, and more resistant to chemicals. Epoxy shrinks less in curing, resulting in smoother, void free surfaces.

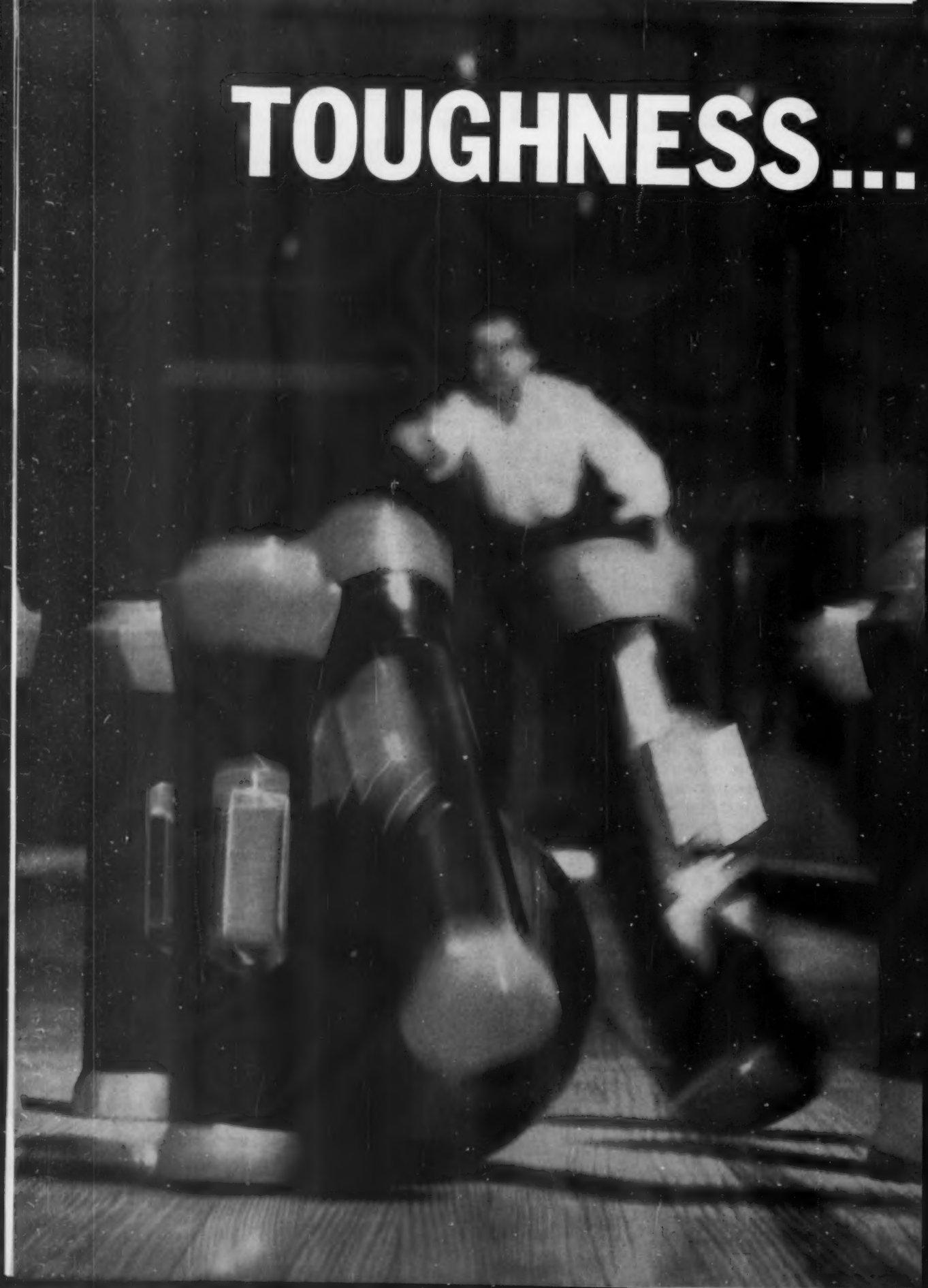
These very advantages which benefit the boat owner, of course, also apply to the builder. If he can get a better boat at only a slightly increased expenditure, his sales potential is enhanced. The actual construction cost figures for a 13-ft. 9-in. hand lay-up hull show that an epoxy boat can be built for only a little more than a polyester boat. For a typical 13-ft. 9-in. boat hull, the resin costs were $23.85 for polyester and $29.50 for epoxy. As a substantial weight reduction was possible with epoxy, the final costs were $48.60 for polyester and $49.60 for epoxy. This does not include labor. Labor costs utilizing a combination of hand lay-up and flocking with the resin applied by means of the Gusco Process spray equipment are directly comparable to similar polyester systems now being used.

Spraying has brought a new look to epoxies —a look which holds great promise for the entire boating industry.—End

* New Products Market Development Dept., Union Carbide Plastics Co.

[1] Produced by Sock Boat Corp., Cold Spring Harbor, L. I., N. Y.

TOUGHNESS...



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No-Load Heat Distortion Temperature		128°C (262°F)
Secant Modulus (Stiffness), psi	D 638-58T	100,000
Tensile Strength, psi	D 638-58T	3300
Ultimate Elongation, %	D 638-58T	45
Tensile Impact (ft. lbs./cu. in.)		50

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Tumbling thermoplastics

Not ordinarily thought of as a thermoplastic finishing operation, tumbling can be used to real advantage in finishing some thermoplastic parts. Here's what can be done and how to go about it

By Joseph Ashmore†

Many compression molders are familiar with tumble finishing of plastics parts. However, with few exceptions, the process is seldom seen being used by injection molders or other fabricators of thermoplastic products. This may be due to the fact that the utility of tumbling as a finishing process for thermoplastics is actually not generally known.

What thermoplastics can be tumbled? Since tumbling success depends on the material, part size, part design, and the job to be done, no black and white answer can be given to the question. Whether the process can be used will depend on finding the proper tumbling system. With some thermoplastics, such as the cellulosics and methyl methacrylate, much experience has been accumulated and finding the system to use is an easy job. A good example of the type of finish which can be obtained on methyl methacrylate parts is shown in Fig. 1, above. A cellulose acetate temple piece is shown as the rough stamping and

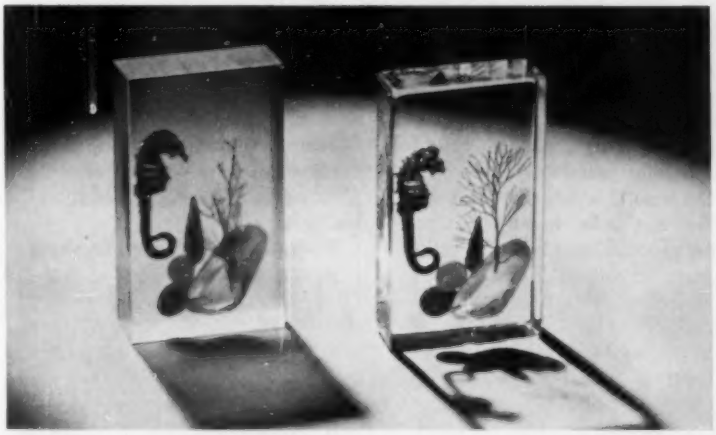

FIG. 1: Methyl methacrylate embedment. Piece at left appears as originally cut from block. At right is a similar embedment after tumbling, showing the high polish imparted by the process.

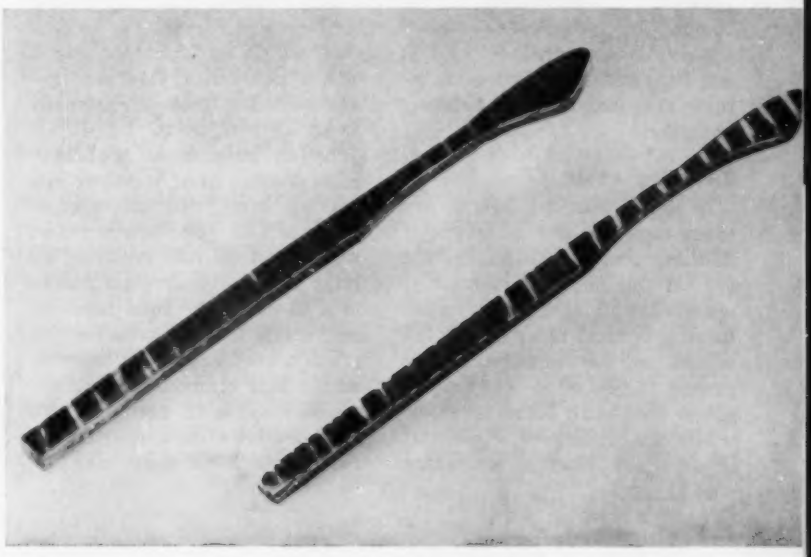

FIG. 2: Eye-glass temple pieces. Part at left is shown as originally cut from sheet with rough edges. Tumbling has removed the rough edges and highlighted the coloring of piece shown at right.

* Reg. U.S. Pat. Off.

† President, Tumb-L-Matic Inc., Stamford, Conn.

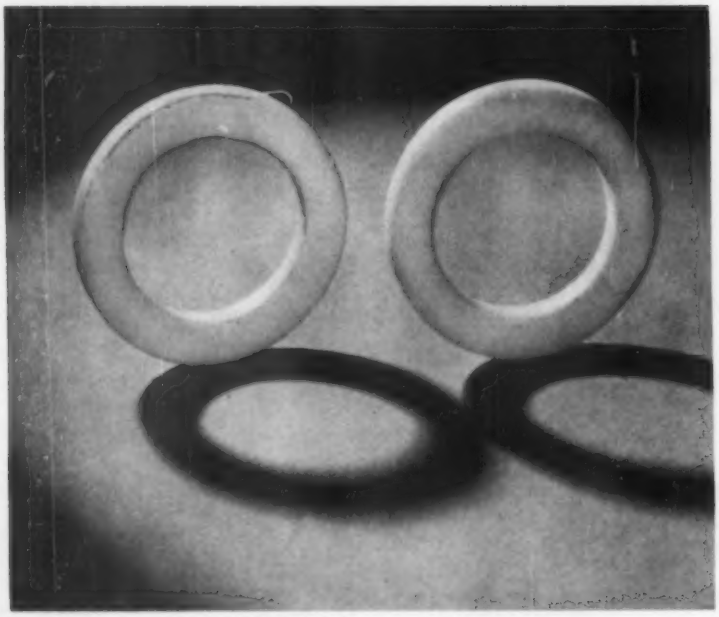

FIG. 3: Teflon washer stamped from sheet on left has clearly visible rough edges and burrs which have been removed by tumbling as shown on the washer at right.

after tumbling in Fig. 2, p. 109. Notice particularly how the tumbling has highlighted the variegated color pattern.

Even soft, tough materials like Teflon can be finished by the tumbling process. Note how the Teflon washer shown in Fig. 3, above, has had the rough edges (produced in stamping from a sheet) removed by tumbling.

Parts of other materials, such as styrene and nylon, have also been successfully and economically tumble finished by finding the proper system of equipment, media, and cycle for the job. Since each part and material generally present a different problem, the tumbling equipment supplier should be consulted for advice and suggestions that will be helpful in designing a tumble finishing operation.

Tumbling costs

In what situations does it pay to use tumbling as a thermoplastic finishing process? Generally, the use of tumbling equipment is worthwhile investigating when there is a hand finishing job involved, as for instance, where parting lines must be erased, where flash must be removed, or where the buffing of a material is necessary after a machining operation. It is especially desirable to evaluate the advantages of using tumbling where large volumes of small parts must be polished or cleaned on a continuing basis.

When the cost of hand finishing begins to exceed the cost of tumbling equipment, the fabricator should definitely consider the installation of tumbling equipment if it can be adopted to provide the desired finish on the part. It is estimated that when the production of more than 1000 finished pieces of plastic per month is involved, the purchase of tumbling equipment is generally justified. Using a common size barrel and average sized pieces, the costs of finishing 1000 pieces per month would run about 6½¢ per machine dollar that is normally spent for equipment.

As an example of the lower costs possible using tumbling, one manufacturer with an installation of 48 two-compartment, wood-lined barrels produced 25 gross of finished eyeglass frames in a 40-hr. week. Total tumbling cost of the frames, including depreciation of equipment, costs of media, and compounds, was approximately $2.12 per gross. To hand-finish the same quantity, the cost of the labor alone was approximately $7.00 per gross. In other words, savings of up to 70% were realized.

What tumbling does

Three types of mechanical action take place during the tumbling operation; 1) chipping, which removes burrs by breaking them off the work piece; 2) grinding and polishing, which results when an abrasive or compound is used with suitable media to rub against the part; and 3) flowing or peaning, which, when the parts are malleable, can densify the surface. In general, the process consists of the removal of surface or projecting material or the hammering of a surface. Control of the process depends on the selection of the proper equipment, batch formulation, and operation technique.

There are several process variables that will determine the exact tumbling system to use. These include 1) the material to be finished; 2) shape and size of the part; 3) equipment; 4) tumbling media, and 5) work loads.

Material: The microstructure of thermoplastics varies from material to material. Some are dense throughout (cellulosics, acrylics), others have porous subsurface structures (polystyrene, nylon). These differences will call for different batch formulations and tumbling media.

Shape: Exposed corners receive maximum action, followed in order by exposed edges, convex surfaces, flat surfaces, concave surfaces, down to slots and holes which may receive little action. Pieces with protrusions may block off sections from being finished. Some pieces may require additional finishing operations for a complete job.

Size: It is difficult to place a limit on the size of the pieces. Parts with as much as 24 sq. in. are being tumbled. At the other extreme, disk-shaped pieces with diameters as small as ⅛ in. and thicknesses of 1/16 in. are also being successfully finished.

Barrels: These operate either horizontally or at an angle of about 40° with the horizontal. The horizontal barrel is preferred for most tumbling work and is generally used for thermoplastics.

Barrels are made in many shapes. The most commonly used consist of two end plates and have 6, 8, 10 or 12 flat longitudinal sides. An eight-sided barrel has generally proven to be most suitable for thermoplastics. Sizes range from 14 in. to 36 in. diameter and occasionally even larger sizes are possible.

Lengths usually vary from 20 in. up to 48 in. and in some cases longer to meet special requirements. Most popular is a barrel with a 30-in. diameter, 30 in. long with two separated compartments.

Doors are provided for loading or unloading and are equipped with quick locking devices. Fixed or variable speed drives are used, the latter being employed where it is desirable to start the barrels slowly and increase the speed after the load is tumbling. This technique is used mostly for larger work pieces.

Barrels are usually made of steel outer shells lined with various other materials. For thermoplastics, hard rock maple wood and Neoprene are generally preferred. Maple liners are used for burnishing operations since the walls are resilient and avoid peaning of the soft thermoplastic surfaces. They are not as good for deburring, since the maple lining wears out rapidly when abrasive cutting compounds are used. Neoprene linings are preferred not only because of their highly superior wear resistance but also their chemical resistance to tumbling compounds.

Media: The use of media serves several purposes. First, it keeps the work pieces apart and provides a cushion to prevent damage as the parts tumble over each other. In addition to this, the media modify the tumbling characteristics of the total mass by virtue of their own properties which are generally different from those of the work pieces.

Media also modify the type of surface action that takes place on the work piece. If grinding action is desired, cutting-type media are used. If a burnishing is desired, a hard, smooth medium is chosen for the job.

Two general types of media are used for tumbling thermoplastics: 1) irregularly shaped and sized, and crushed; 2) regular particles of uniform size and shape. Both types are available in many sizes to suit particular needs. They can be made of wood, felt, nut shells, or metal. Some of the media used are illustrated in Figs. 4, 5 and 6, above. In Table I, p. 112, are listed several of the types for tumbling thermoplastic parts, showing the range of sizes used and the type of finishing job for which they are most commonly employed.

The selection of the proper size of media is especially important when parts have inside holes to be finished. Obviously, the size of the media to be selected must be such that they can pass through the holes in order to develop the finishing action. Sometimes a mix of two types of media may be

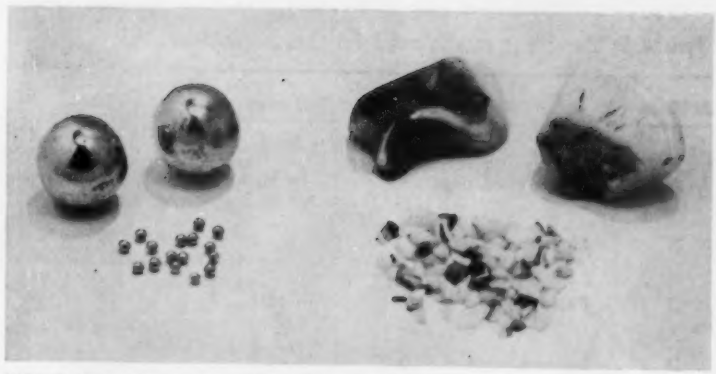

FIG. 4: Tumbling media. Left: steel balls 1/16 and 1/2 in. in diameter. Right: Ivory nut chips in largest and smallest sizes.

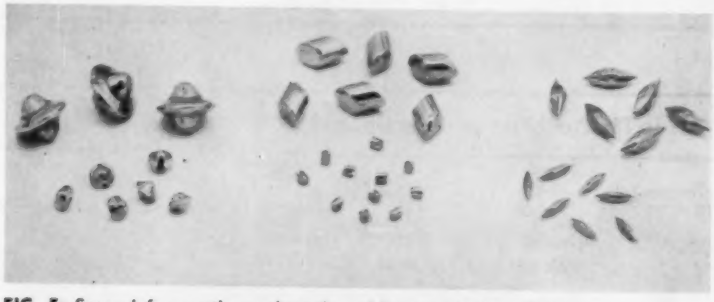

FIG. 5: Several frequently used steel tumbling media from left to right: 1/8 and 3/8 in. and 1/8 in. diameter balcones; 1/16 and 1/4 in. diameter diagonals; 1/16 in. pins.

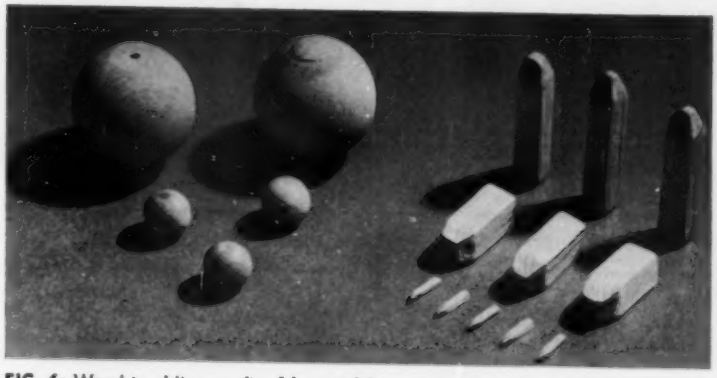

FIG. 6: Wood tumbling media, 1/4- and 3/4-in. diameter balls on left and 1/4 to 3/4 in. long pegs on right.

Table I: Tumbling media used for thermoplastics

Medium	Type	Size range	Use
		in.	
A	Maple wood pegs	1/16 by 5/16 to 1/4 by 1 1/4	Cutting, deburring, polishing
B	Maple wood balls	3/8 diam. to 7/8 diam.	Cutting, deburring, deflashing, polishing
C	Felt blocks	1/2 in. sq. to 1 1/4 in. sq.	Cutting, deburring
D	Lignum vitae	1/2 in. sq. to 1 in. sq.	Cutting, polishing
E	Ivory nut chips	1/8 to 7/8	Cutting, deburring, deflashing, polishing
F	Steel shot and shapes	1/16 to 1/2	Deflashing

Table II: Tumbling compounds used for thermoplastics

Compound	Composition	Use
A	Graded hardwood sawdust impregnated with oils and coarse abrasives.	Cutting & deburring
B	Graded hardwood sawdust impregnated with oils and medium abrasives.	Cutting, deburring, & smoothing
C	Graded hardwood sawdust impregnated with oils and fine abrasives.	Smoothing
D	Graded hardwood sawdust impregnated with oils and polishing powders.	Smoothing, polishing, & lustering
E	Cream base with extra fine abrasives and polishing powders.	Smoothing, very light cutting, & polishing
F	Cream base with polishing powders.	Lustering

necessary. Size is also an important consideration in the separation of the media from the work pieces after the tumbling process is completed. If the work pieces and media are roughly the same size it will be difficult to separate them by a simple screening operation. If steel media are used a magnet can be employed.

Since the medium is also tumbled, it, too, will be subjected to "finishing" by the work pieces. Because of this action, media have varying service lives, depending on the material from which they are made. Thus, media should be checked from time to time to determine whether a new batch is needed to maintain the proper finishing conditions. If media suffer attrition in size, they should be saved, because they may still be usable when smaller sizes are needed.

Various polishing compounds are used in addition to the media, depending on the surface finishes desired. In general, these consist of an abrasive or polishing material, in or on a carrier. For thermoplastics, graded hardwood sawdust with oils and abrasives, and creams with suspended abrasives are used. Several of these compounds are described in Table II, left, together with their various uses.

Working loads: Generally, the tumbling barrel will operate most satisfactorily when the mixed load occupies about 60% **(To page 193)**

Table III: Guide to tumbling some thermoplastics

Plastic to be finished	Approx. size of parts	Finish desired	Typical media used[a]	Approx. ratio parts to media	Typical tumbling compound[b]	Tumbling cycle, 2 cu. ft.
	oz.					hr.
Lucite	1 to 4	Rough[c]	A,B,C,E	1:1	A,B	4 to 24
		Smooth	A,B,E	1:1	D,E	8 to 60
		Polish	A,B	1:1	F	4 to 8
Acetate	1 to 8	Rough	A,B,C,E	1:2	A,B	8 to 48
		Smooth	A,B,E	1:2	D,E	16 to 48
		Polish	A,B	1:2	F	8 to 16
Butyrate	1 to 6	Rough	A,B,C,E	1:2	A,B,C	8 to 48
		Smooth	A,B,E	1:2	D,E	16 to 48
		Polish	A,B	1:2	F	8 to 24

[a] See Table I, above, for identification.
[b] See Table II, above, for identification.
[c] Rough means cutting operation such as deflashing, cleaning holes, etc.

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Thermal and shear degradation in polyethylene extrusion

By Hans Schott* and W. S. Kaghan*

Most data published on the effect of shear on bulk polymers indicate that degradation takes place. Present work shows that molten polyethylene resists shear degradation under normal extrusion conditions. Degradation occurs only at higher temperatures, and is, therefore, thermal. Repeated extrusions of two low-density polyethylene resins at 400 and 504° F. did not change their melt viscosity or intrinsic viscosity. Repeated extrusions of a third low-density resin at 646° F. reduced the viscosity continuously. After eight extrusions, the apparent melt viscosity was reduced by 46% and the weight-average molecular weight by 7 percent. Extrusions of high density resin at 325° F. produced no change, but successive extrusions at 525° F. increased the viscosity continuously. The total increase after 10 extrusions was 29% in apparent melt viscosity and 7% in weight-average molecular weight. High temperature and possibly oxidation, rather than shear, were the causes of the increase in molecular weight of the high density polyethylene extruded at 525° F. and of the low density polyethylene extruded at 646° F. This was demonstrated by the fact that extrusions under higher shear stresses but lower temperatures produced no change. Significance lies in the conclusion that polyethylene can be recycled many times without significant changes in the polymer, provided excessive temperatures are not employed.

Various changes in polymers can be caused by heat, light, ionizing radiation, ultrasonics, mechanical action or the attack by oxygen or other chemicals. Several recent papers deal with the differing effects of shear, temperature, and oxygen, on bulk polymers in the solid or molten state, (1, 2, 4, 5, 7, 8, 9, 10, 11, 12, 13, 14, 16)[1]. The purpose of the present investigation was to determine to what extent different polyethylene resins are degraded by melt extrusion.

Experimental procedure

Four commercial resins were tested, three low- and one high-density material. They are listed in Table I, right. To ensure uniformity, each of the four resin batches was thoroughly mixed on a ribbon blender.

A 2-in. Davis-Standard extruder with a length/diameter ratio of 22:1 was used. Since the extruder is not vented, the melt was in contact with air. A right-angle adapter reduced the channel diameter to 1 inch. The die was bolted to the flange of the adapter. The die channel was cylindrical, 11.44 cm. (4.504 in.) long, 0.350 cm. (0.1378 in.) in diameter and had a tapered entrance with a 60° included inlet angle. The extruded rod was quenched in a long horizontal trough filled with cold water. The air gap between die exit and water surface was less than 1 cm. (0.3937 in.). The cold extruded rod was continuously fed on a conveyor belt into a pelletizer and chopped up. An air jet and three cloth-covered wipers removed water adhering to the rod.

Pressure was measured with Helicoid-probe chemical gages (American Chain & Cable Co.). The gage was mounted on a section of high pressure pipe connected to the stream of melt by a pressure tap. Its probe, which was filled with silicone oil, was immersed in the melt. Pressure was then registered as the filling oil was displaced from the probe into a Bourdon tube.

The pipe was wrapped in electric heating tape. A thermocouple recessed in the pipe wall ensured constant temperature for the melt in the pipe and the silicone oil in the probe. One pressure tap was

Table I: Descriptions of resins used in experiments

Designation	*Lot No.*	*Manufacturer*	*Density at 25° C. (77° F.)*	*Melt index*[a]	*Additives*[a]
DFD-0114	G-1982	Union Carbide Plastics Co.	0.920[a]	2.0	Antioxidant, slip improver, antiblock
DYNH-3	5764	Union Carbide Plastics Co.	0.914[b]	1.9	None
Dow Type 544E A1 Nat. No. 9	1207956	Dow Chemical Co.	0.923[b]	2.2	Antioxidant, slip improver
Marlex Series 6000 Type 50	2M-358	Phillips Chemical Co.	0.960[b]	5.0	Ionol

[a] Manufacturer's information.
[b] Measured with pycnometer on unannealed samples.

* Film Division, Olin Mathieson Chemical Corp., New Haven, Conn.
[1] Numbers in parenthese link to references at end of article, p. 197.
Presented at the Sixteenth Annual Technical Conference of the S.P.E.

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Table II: Extrusion conditions used for pelletizing runs

Resin	DFD 400° F.	DYNH 504° F.	Dow 646° F.	Marlex 325° F.	Marlex 525° F.
Barrel temperature (metering section), ° F.	351 to 352	449 to 450	545 to 558	295 to 300	457 to 467
Melt temperature, ° F.					
In elbow	390 to 397	489 to 493	648 to 660	318 to 322	508 to 512
At die inlet	397 to 401	499 to 503	652 to 657	318 to 322	511 to 516
At die exit	400 to 402	505 to 507	641 to 645	327 to 330	530 to 533
Flow rate, lb./hr.	18.7 to 19.4	18.7 to 19.4	23.1 to 24.2	10.7 to 11.0	16.6 to 17.4
Shear rate (at die wall), $sec.^{-1}$	750 to 780	785 to 815	1015 to 1060	410 to 426	680 to 730
Number of passes	4	4	10	5	10

Table III: Apparent viscosity of successive extrusions of DFD low density polyethylene at 400° F.

Extrusion No.	1	2	3	4
No. of viscosity measurements	11	7	6	3
Arithmetic mean apparent viscosity, poise	1905	1893	1893	1877
Standard deviation of single measurement, % of mean viscosity	1.5%	1.2%	1.1%	1.0%
Range, % of mean viscosity	±1.8%	±1.7%	±1.4%	±1.3%

located in the reducing elbow, another was situated directly above the die inlet. The two gages were in close agreement.

The temperature of the melt was measured with shielded thermocouples (Thermo Electric Co.) insulated from the threaded holding bolts with Teflon sleeves. Their tips projected into the melt. One thermocouple was located at the elbow, another directly above the die inlet. The melt temperature at the die exit was measured with a thermometer.

Flow rates were measured by weighing the amount of resin collected during a known length of time, usually 2 min., at the die exit or at the discharge of the pelletizer. The maximum shear stresses and rates of shear at the wall were estimated by:

$$T = \frac{PR}{2L} \qquad \text{Eq. 1}$$

and

$$\gamma = \frac{4Q}{\pi R^3} \qquad \text{Eq. 2}$$

where P is the pressure drop, Q the volumetric flow rate, L the length and R the radius of the cylindrical die channel. The ratio of shear stress to rate of shear is the apparent viscosity. Because of close temperature control, reproducibility of the data was good. For a series of 19 apparent viscosities measured at 400 ± 2° F. in the range of 750 to 780 $sec.^{-1}$ on different days, the standard deviation amounted to only 1.6% for a single measurement and to 0.4% for the mean.

Each resin batch was extruded at constant temperature and constant shear rate for the specified number of successive passes. Pressure drops and flow rates were measured at regular intervals during each pass. In addition, two melt flow curves were determined for each batch of resin with extruder and the same die, one for the virgin resin and one for the resin after the last extrusion. The flow curves cover nearly two logarithmic decades of shear rate; melt temperatures were those of the extrudate.

Intrinsic viscosities were also determined for each resin batch before the first and after the last extrusion. Measurements were made in toluene at 80° C. (176° F.) and in alpha-chloronaphthalene at 125° C. (257° F.) for the low- and high-density resins, respectively.

The low-density resins, DFD-0114 and DYNH-3, were extruded four successive times at 400 and 504° F., respectively. One batch of high-density Marlex was extruded five times at 325° F. Another batch was extruded 10 times at 525° F. One batch of low-density Dow resin was extruded 10 times at 646° F. Extrusion conditions for these pelletizing runs are enumerated in Table II, above.

DFD low density resin

A summary of the four successive runs at 400° F. is given in Table III, above. Even though the trend in apparent viscosities is mostly down, the difference between the mean apparent viscosities of the first and the last run is only 28 poises or 1.5 percent. There is no statistically significant difference among the mean apparent viscosities of the four runs. The F value calculated by means of the analysis of variance (6) is far smaller than the critical F value for the 5% probability level.

The flow curves of the virgin resin and of the resin extruded four times coincide (see Fig. 1, p. 120), indicating that their apparent melt viscosities are the

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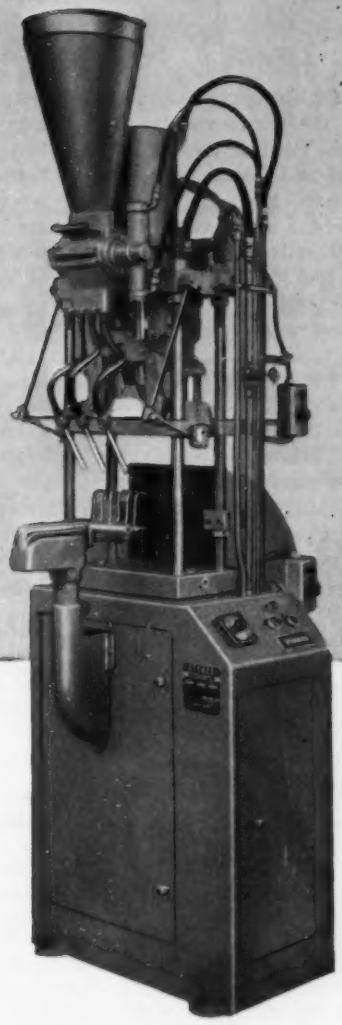

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same over a whole range of shear rates. The exponent of shear stress in the "power law" equation

$$\gamma = K\tau^{s} \qquad \text{Eq. 3}$$

is 2.24 for the virgin resin and 2.22 for the resin extruded four times. The intrinsic viscosities are 0.93, 0.95 and 0.94 dl./g. for the virgin resin, the resin extruded once, and the resin extruded four times, respectively. All these facts indicate that repeated extrusions at 400° F. had no measurable effect on the resin.

DYNH low-density resin

Results of the four successive runs at 504° F. are summarized in Table IV, below. Although statistical analysis indicates that significant change in apparent melt viscosity took place in one of the four runs, additional considerations lead to the conclusion that the viscosities remain substantially unaffected by repeated extrusions at 504° F. These additional considerations are the absence of a trend in melt viscosity with the number of extrusion passes and the fact that the mean melt viscosities of the first and last runs are identical.

The flow curves at 504° F. of the virgin DYNH resin and of the resin extruded four times coincide (see Fig. 1). At shear rates between 60 and 400 sec.$^{-1}$, the exponents of shear stress in the power law are 1.60 and 1.56, respectively. The intrinsic viscosities are 0.89, 0.88, 0.90 and 0.90 dl./g. for the virgin resin, and the resin extruded once, twice and four times, respectively. These values are practically identical. It is unlikely that oxidative degradation of DYNH offset an increase in molecular weight due to cross-linking, because the original sample and DYNH extruded four times have the same infra-red spectrum. Extrusions of DYNH at 504° F. produced no measurable change in the resin.

Marlex high-density resin

To separate the effect of shear and temperature, one batch was extruded at low temperature and high shear, another at higher temperature and lower shear.

Results of the five extrusions at 325° F. are summarized in Table V, below. The apparent viscosities measured during the five extrusions are not significantly different, because the *F* value calculated by means of the analysis of variance is below the critical *F* value for the 5% probability level. The 325° F. flow curves of the virgin resin and of the resin extruded five times at 325° F. coincide, as shown in Fig. 2, p. 122. In the range of shear rates between 35 to 300 sec.$^{-1}$, the exponent of shear stress in the power law is 1.83 for the former and 1.82 for the latter. Both intrinsic viscosities are 0.91 dl./g. Hence, under the extrusion conditions described, the resin suffered no degradation.

Results of the 10 successive extrusions at 525° F. are summarized in Table VI and in Fig. 3, p. 122. The apparent melt viscosity at 707 ±25 sec.$^{-1}$ increased by about 3% in every pass but one. The viscosity of the resin extruded 10

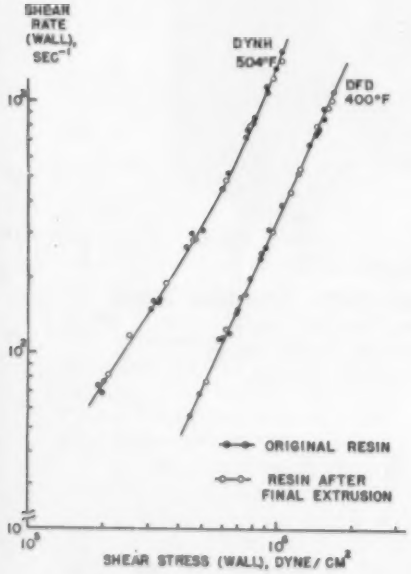

FIG. 1: The flow curves of the original resin and of the resin extruded four times coincide for both low density polyethylenes. Conclusion: Extrusion did not degrade the resins.

Table IV: Apparent viscosity of successive extrusions of DYNH low density polyethylene at 504° F.

Extrusion No.	1	2	3	4
No. of viscosity measurements	12	7	5	3
Arithmetic mean apparent viscosity, poise	993	986	1009	992
Standard deviation of single measurement, % of mean viscosity	1.0%	0.6%	1.0%	1.1%
Range, % mean viscosity	±1.5%	±0.9%	±1.2%	±1.1%

Table V: Apparent viscosity of successive extrusions of high density polyethylene at 325° F.

Extrusion No.	1	2	3	4	5
No. of viscosity measurements	8	5	7	3	4
Arithmetic mean apparent viscosity, poise	3456	3439	3404	3410	3472
Standard deviation of single measurement, % of mean viscosity	0.9%	0.9%	2.5%	0.75%	1.15%
Range, % of mean viscosity	±1.4%	±1.0%	±3.6%	±0.8%	±1.6%

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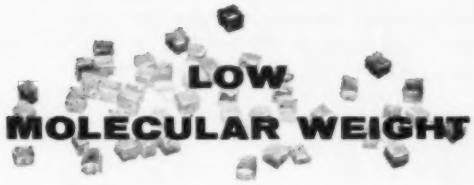

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times was 29% higher than the extrapolated viscosity of the virgin resin, or 25% higher than the viscosity of the resin extruded once.

The coefficient of correlation (6) between the number of successive extrusions N and the apparent melt viscosity η^* is 0.98; the equation of regression line is

$$\eta^* = 1229.5 + 36.5\,N \qquad \text{Eq. 4}$$

Each 525° F. extrusion but one increased the apparent melt viscosity and hence the molecular weight of the resin. Extrusion at higher temperatures results in decreased melt viscosity.

The melt flow curves of the original resin and of the resin extruded 10 times are nearly parallel, with the latter displaced towards higher shear stress (see Fig. 2). The 10 extrusions caused a slight decrease in density, from 0.958 to 0.956. The intrinsic viscosity of the virgin resin is 0.91, that of the resin extruded 10 times 0.95 dl./g. According to Equation 1 of Ref. 3, these values correspond to weight-average molecular weights of 92,250 and 98,500, respectively. A 7% increase in weight-average molecular weight is reflected in a 4.5% increase in intrinsic viscosity and a 29% increase in apparent melt viscosity at 707 sec.$^{-1}$. This indicates that melt viscosity is far

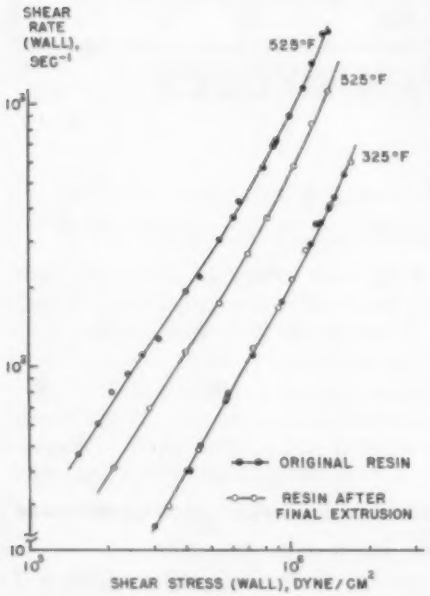
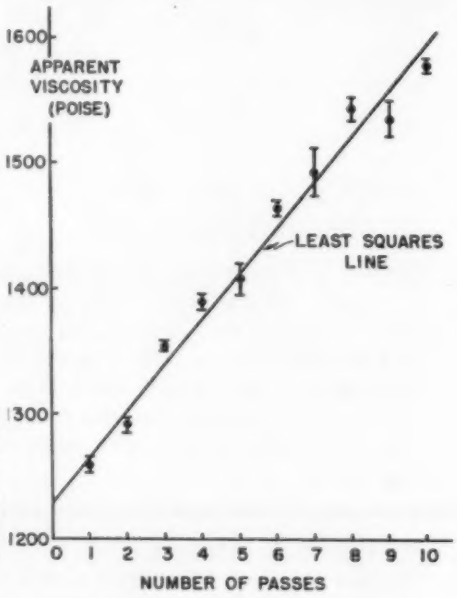


FIG. 2: The flow curves of Marlex before and after extrusions at 325° F. coincide. Ten extrusions at 525° F. shift the curve towards higher stresses, indicating an increase in molecular weight. ←



→ **FIG. 3:** Successive extrusions at 525° F. increase the melt viscosity of linear polyethylene. Bars represent standard deviations of mean viscosities.

Table VI: Apparent viscosity of successive extrusions of high density polyethylene at 525° F.

Extrusion No.	*No. of viscosity measurements*	*Arithmetic mean apparent viscosity*	*Standard deviation of single measurement*	*Range*	*Cumulative increase in apparent viscosity*
		Poise	*% of mean viscosity*	*% of mean viscosity*	*% of viscosity of virgin resin*
0	*	1223	—	—	0.0%
1	14	1260	1.9%	±2.9%	3.1%
2	11	1292	1.5%	±2.5%	5.7%
3	8	1354	0.8%	±1.0%	10.7%
4	6	1389	1.0%	±1.2%	13.6%
5	4	1408	1.7%	±2.0%	15.2%
6	3	1464	0.6%	±0.7%	19.7%
7	4	1493	2.5%	±3.0%	22.1%
8	3	1543	0.9%	±1.0%	26.2%
9	3	1535	1.4%	±1.6%	25.5%
10	4	1578	0.8%	±0.9%	29.0%

* Extrapolated value.

the encapsulating medium. Figure

Table VII: Apparent viscosity of successive extrusions of Dow low-density polyethylene at 646° F.

Extrusion No.	No. of viscosity measurements	Arithmetic mean apparent viscosity, Poise	Standard deviation of single measurement, % of mean viscosity	Range, % of mean viscosity	Cumulative decrease in apparent viscosity, % of viscosity of virgin resin
0	[a]	4230	—	—	0.0%
1	11	3914	3.0%	±4.5%	8.1%
2	9	3623	1.7%	±2.4%	14.3%
3	6	3277	1.7%	±2.1%	22.5%
4	9	3050	3.2%	±4.0%	27.9%
5	8	2651	2.2%	±3.5%	37.3%
6	7	2529	2.5%	±2.8%	40.2%
7	4	2320	1.7%	±2.2%	45.2%
8	5	2273	1.1%	±1.4%	46.3%
9	5	2122	1.9%	±2.5%	49.8%
10	10	1961	2.6%	±3.6%	53.6%

[a] Extrapolated value.

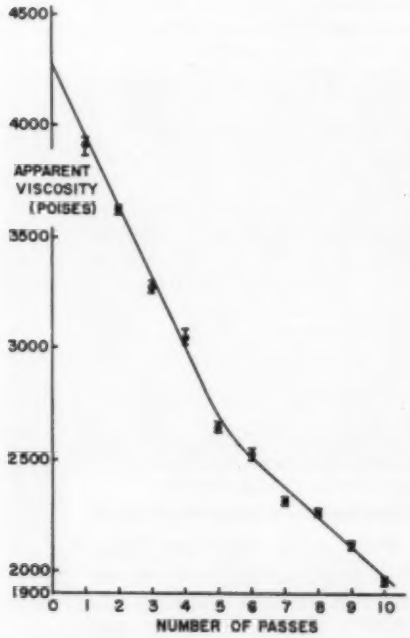


FIG. 4: Successive extrusions at 646° F. decrease the melt viscosity of low density PE. Bars represent standard deviations of mean viscosities.

more sensitive to changes in molecular weight or structure than is solution viscosity. Temperature, rather than shear, was the main factor in the increase in molecular weight in melt extrusion. Extrusion at 325° F. and 1.4 × 10^6 dyne/cm.^{2} did not change the apparent melt viscosity whereas extrusion at 525° F. and 0.9 to 1.1 × 10^6 dyne/cm.^{2} did increase it.

Whereas extrusion of DYNH at 504° F. left melt and solution viscosity unchanged, extrusion of Marlex at 525° F. increased viscosity and molecular weight. Marlex has two and one-half times as much unsaturation as DYNH. Of this, 94% consists of terminal double bonds, as compared to 15% for DYNH. Thus, Marlex has 16 times as much terminal unsaturation as DYNH (15). Terminal unsaturation is most readily attacked by oxygen or other reagents, leading to branching and cross-linking. This may have been responsible for the increase in viscosity and molecular weight on extruding Marlex at 525° F., as contrasted with the lack of change in DYNH extruded at 504° F. Comparison of the infra-red absorption spectra of virgin Marlex with Marlex extruded 10 times at 525° F. shows a slight increase in carbonyl content in the latter. The infra-red absorption spectra of DYNH before and after four extrusions at 504° F. were the same.

Dow low-density resin

Results of 10 successive extrusions on low density resin at the relatively high temperature of 646° F. are summarized in Table VII, above. The apparent melt viscosity at 1030 sec.$^{-1}$ decreased by about 5% during each pass. The resin extruded 10 times had less than half of the apparent melt viscosity of the original resin. The initial slope of Fig. 4, left, up to and including the fifth pass, is given by

$$\eta^* = 4233 - 310\,N \qquad \text{Eq. 5}$$

It was concluded that temperature rather than shear is the chief cause of this degradation, because extrusions under higher shear stresses at 400° F. did not change the apparent melt viscosity of a similar low-density resin, DYNH.

Intrinsic viscosities of the original resin and of the resin extruded eight times are 0.89 and 0.84, respectively. This corresponds to respective weight-average molecular weights of 178,000 and 166,000. A 6.7% decrease in weight-average molecular weight is reflected in a 5.6% decrease in intrinsic viscosity as well as a 46% decrease in apparent melt viscosity.

Summary

Repeated extrusions of the low-density polyethylenes DFD-0114 at 400° F. and DYNH-3 at 504° F. produced no measurable changes in the resins. **(To page 197)**

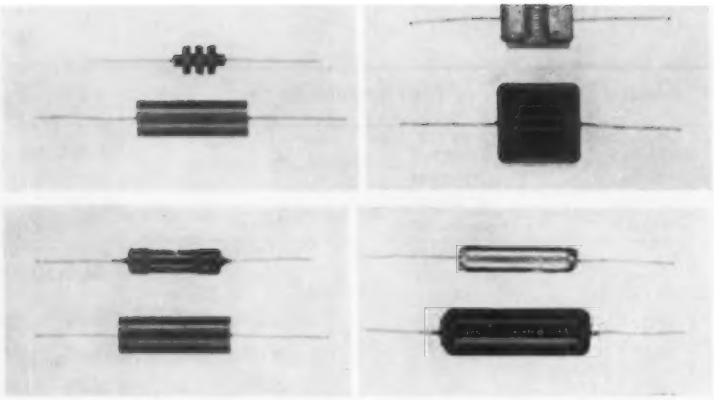


FIG. 1: Coil, resistors, and capacitors before (top) and after encapsulation.

How to encapsulate with alkyds

Current molding practices

used to encapsulate electrical component parts

By J. J. Moylan* and J. T. Long*

Emphasis on automation and miniaturization in the electronics industry has contributed to the popularity of encapsulation of individual components such as resistors, capacitors, and small coils. The aim of encapsulating these items in an insulating medium is to isolate the unit electrically and thermally and to protect it from moisture and physical damage. In addition, the dielectric material should function so efficiently that the above aims may be achieved in a minimum space and with maximum dimensional regularity, surface smoothness, and freedom from internal voids.

Encapsulating by molding a thermosetting material around the electronic subassembly in matched steel molds is achieving these aims in an increasing number of instances. Molding pressures assure smooth, void-free parts with exactly centered electrical leads and complete reproduction of the most minute physical detail.

The specific use of alkyd material has become especially popular because of its electrical and thermal properties—which result in high functional efficiency of the unit in a minimum space; and its low pressure molding characteristics—which prevent distortion of the subassembly during molding. Light weight alkyd presses can be integrated into the manufacturing assembly lines, and high-speed cure achieves maximum production from a given number of mold cavities.

The process by which an electronic component, or subassembly, is encapsulated with an alkyd molding compound has been standardized over the past few years. Many mica, polyester, ceramic, and paper capacitors are now so processed, as well as deposited carbon resistors and various types of small inductance coils. In each case, one or more of the above mentioned advantages played a major role in the selection of an alkyd material for the encapsulating medium. Figure 1, left, demonstrates the variety of units which have been encapsulated with the various alkyd compounds. This picture shows subassemblies before and after they were molded.

In general, it is necessary to cope with two or more lead wires extending from the component to be encapsulated and, because of this, rather specialized tooling is utilized. In the more common case of two axial leads extending from opposite ends of the unit, a standardized process will be described in detail. Where different lead wire arrangements are present, or where larger parts are involved, variations in this basic process have been worked out. Two types of alkyd compounds can be considered for encapsulating a component: 1) alkyd putty and 2) granular alkyd. A proper selection of material is determined by the size of the unit to be molded, and by the amount of molding pressure which the unit can withstand without distortion or damage.

Generally, if the unit to be molded is rather small (less than 3/16 in. diam. for round cross-section), and can withstand a molding pressure of 1500 to 2000 p.s.i., the granular alkyd compounds should be considered. If the unit is larger, or if low molding pressure (700 to 800 p.s.i.) are necessary to prevent damage to the unit, the alkyd putties are usually the answer. Normally, more cavities can be utilized with the granular alkyd than with the putty, so a higher production rate can be obtained.

Encapsulation with alkyd putty

The process of encapsulation with alkyd putty is very similar to the encapsulation process with granular alkyd. In each case, very similar molds, loading fixtures, and press equipment are utilized. With the putty material, an extruder is usually used to form the material into strips; with the granular compound a loading board delivers the correct charge of material to the mold cavity. Often, granular alkyd is preformed into strips before molding.

A typical process for the encapsulation of polyester tubular capacitors in alkyd low pressure

* Allied Chemical Corp., Plastics & Coal Chemicals Div., Technical Service Laboratory, Toledo, Ohio.

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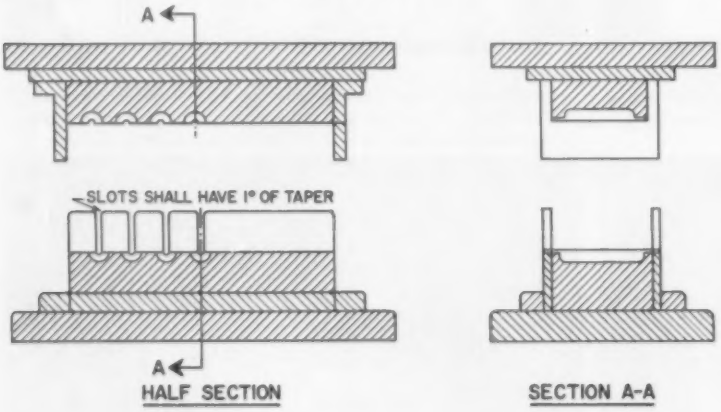
molding putty is designed for encapsulating subassemblies having two centered axial lead wires. With modifications, it can be applied to resistors, ceramic capacitors, paper tubular capacitors, mica capacitors, choke coils, etc.

The encapsulating press is usually located next to the subassembly fabricating area. It is generally an air operated arbor press which will deliver 4 to 10 tons on 80 p.s.i. line pressure. The use of arbor presses eliminates stress rods which would interfere with the loading operation. A typical press would be equipped with control valves permitting adjustment of final closing speed and would be activated by two safety buttons which start an automatic timer controlling the closed time.

The mold usually consists of a single row of 8 to 15 cavities so arranged that the subassembly lead wires protrude from the front and back during the molding cycle. It should be fabricated from tool steel (hobbing steel is frequently used). All molding surfaces should be hardened to about 50 to 55 Rockwell and highly polished. Chrome plating is recommended. The mold is electrically heated with cartridge type heaters controlled by a thermostat. Indicator lights are recommended since they make adjustment and service much easier. The mold is operated in the range of 290 to 320° F.

Figure 2, below, is a sketch of a typical mold used in the encapsulation of a subassembly having two centered axial lead wires. As shown, the most satisfactory results are obtained by designing a radius at the ends of the unit so as to provide rounded corners, rather than sharp ones. It also has been found that sidewalls on the mold are quite advantageous in that they provide the necessary back-pressure for a dense molding. These are the slotted sections shown in the drawing.

FIG. 2: Sections of the mold used for encapsulation of electrical components using alkyd resin putty. Clearance between punch and cavity should be 0.010 to 0.020 inch. Cavities should also be chrome finished.



In addition to the mold itself, there is a bench jig mounted on the work area in front of the press and two clamping fixtures which are alternately placed in the mold on successive cycles.

Figure 3, below, shows these two fixtures which are necessary for the proper alignment of the inserts and putty strip prior to loading in the mold. The slots in the bench jig and the clamping fixture correspond directly to the slots in the sidewalls of the mold.

Alkyd putty is produced on both ram and screw type extruders. In the former, air cylinders are used to drive a piston which develops up to 3000 p.s.i. in the extrusion cylinder, forcing a ribbon of material through one or more orifices in the extrusion head. The ribbon cross-section is determined by the orifice design. It is cut to the proper length by the extruder operator who feeds the alkyd putty into the machine.

The screw type extruder is frequently water-jacketed around the barrel to reduce frictional heat. The screw is driven by a ¾- to 1½-hp. motor and usually turns at 30 to 60 r.p.m.

The hydraulic type is generally cheaper, simpler, easier to clean, and has less tendency to heat the material. The screw type, however, is usually more productive.

Figure 4, p. 128, shows a basic piston type extruder, along with a view of the orifice used to form the ribbon. It has been found that a smoother ribbon results when the orifice is made slightly thicker at the ends than at the center.

Assuming a supply of subassemblies is within convenient

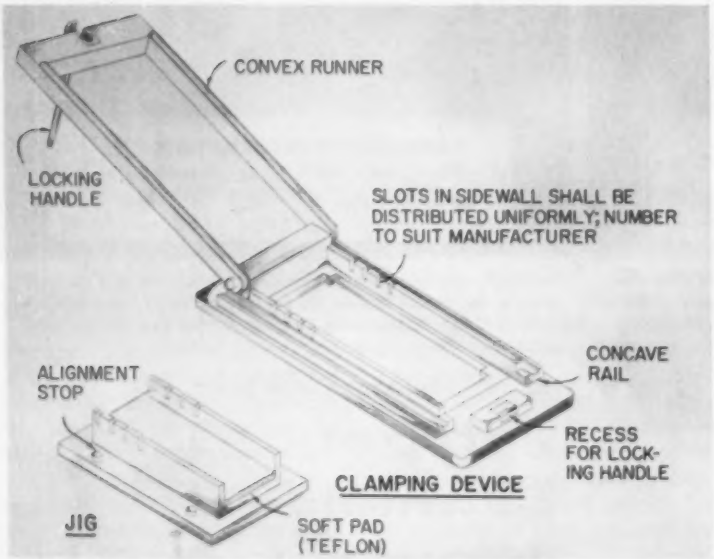


FIG. 3: Jig and clamp fixture that are used for loading the mold shown in Fig. 2, above.

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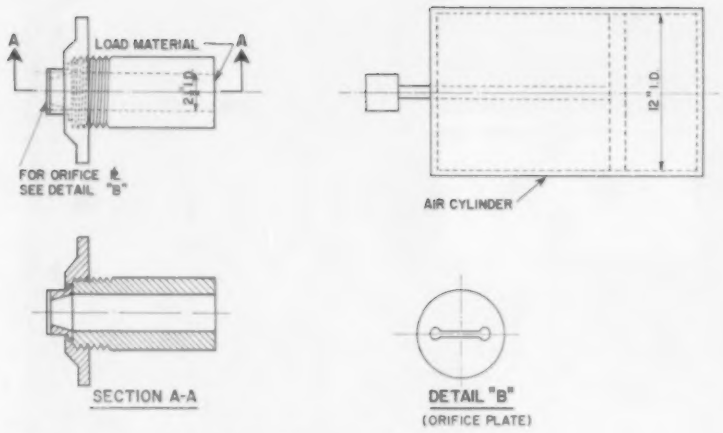


FIG. 4: Piston or ram type extruder used for making preformed strips from alkyd resin putty.

reach of the press operator, the molding sequence that is used is as follows:

1. One of the clamping fixtures is placed over the bench jig and a ribbon of alkyd putty positioned over the Teflon pad.

2. The proper number of subassemblies is positioned over the ribbon with their leads located in the orienting slots of the bench jig in which the putty strip has been positioned.

3. The clamping fixture is clamped on the lead wires and the ends of the putty ribbon wrapped over the top of the subassemblies in the slots.

4. The clamping fixture, complete with alkyd-wrapped subassemblies, is lifted from the bench jig and positioned in the press on the mold.

5. The molding cycle is started by pressing two safety buttons which close the mold and start the automatic timer.

6. The operator positions the second clamping fixture on the bench jig and repeats the assembly operation. When the mold opens, the first clamping fixture containing the now encapsulated units is removed from the mold and unclamped, depositing the units in a tote box. The whole cycle is then repeated.

A typical operation such as above will produce 50 to 60 cycles per hour. The number of cavities in the mold is determined by the number of subassemblies the operator can position in the bench jig during the molding cure cycle. (Usually 12 to 15 in approximately 30 seconds.)

Subsequently, the encapsulated units are deflashed (by wheelabrating, tumbling, or jig deflashing); degreased (usually by a trichloroethylene vapor degrease method); color coded and printed (usually silk screen); and sometimes wax impregnated before packaging is done.

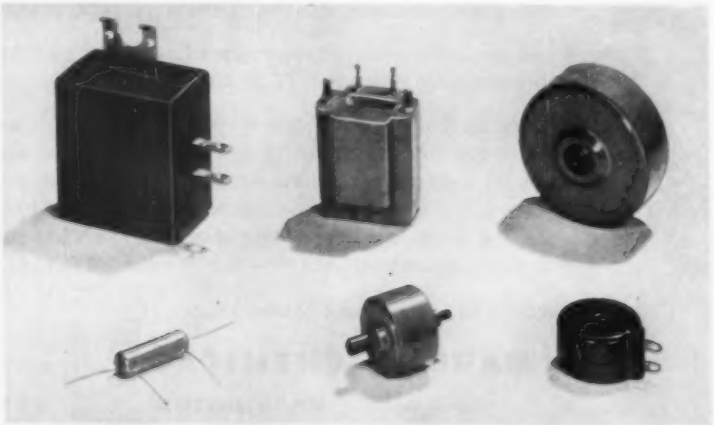
Encapsulation with granular alkyd

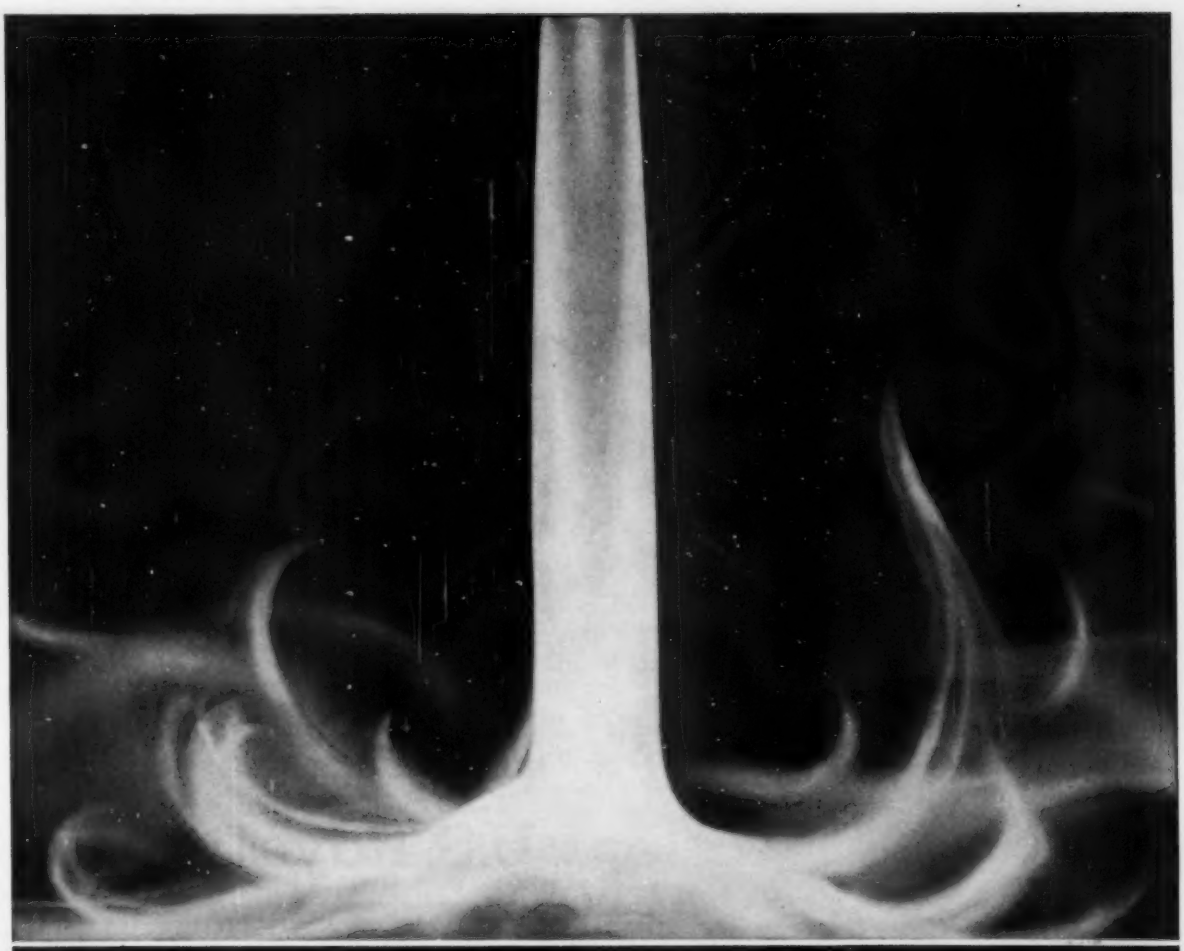
The molding operation using granular alkyd is very similar to that used with alkyd putty. The clamping fixture is placed over the bench jig in the same manner as with the putty. The subassemblies are positioned in this fixture with their leads located in the orienting slots of the bench jig, the clamping fixture is clamped on the lead wires, and the clamping fixture, complete with subassemblies, is positioned in the mold. The granular molding powder is then discharged into the mold cavities by means of a volume loading board. The operation then continues in the same manner that has been described for the alkyd putty.

Alkyd putty containing reinforcing glass fiber is frequently used on larger units where environmental stress cracking may be a consideration, especially if a thermal shock test is required. Since extrusion may cause unwanted orientation of the glass fiber, it is sometimes more efficient to use sheeting and cutting techniques in this material to produce ribbon preforms.

Encapsulation with alkyd molding compounds has not been confined to components with two centered axial leads. As shown in Fig. 5, below, a number of specialized units which do not fall into the above classification have been successfully molded. These parts include solenoid and toroid coils, units with multiple and non-axial leads, printed circuitry, small transformers, and commutators. Each of these applications has required special tooling and techniques which vary somewhat from the more common operation described previously. However, they demonstrate the many varied types of encapsulation which can be accomplished with the use of alkyds.—**End**

FIG. 5: Various alkyd-encapsulated components with multiple and non-axial leads.





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Chlorowax 70	(parts by weight)	—	12.5
Antimony Trioxide	(parts by weight)	—	12.5
Luperco ATC	(parts by weight)	2.0	2.0
3 oz. Glass Mat	(parts by weight)	60.0	60.0
Flexural strength psi (dry)		26,400	27,500
Flexural strength psi (wet)		24,000	25,000
Tensile strength psi (dry)		15,000	15,700
Tensile strength psi (wet)		14,000	14,300
Flame-out (seconds)		Burns	1
POLYETHYLENE SYSTEM*			
Polyethylene Resin	(parts by weight)	100.0	85.0 — 63.0
Chlorowax 70	(parts by weight)	—	7.5 — 18.5
Antimony Trioxide	(parts by weight)	—	7.5 — 18.5
Antioxidant	(parts by weight)	.5	.5
Tensile strength (psi)		1,800	1,650—1,500
% elongation		600	590— 200
Flammability		Burns	Self-extinguishing

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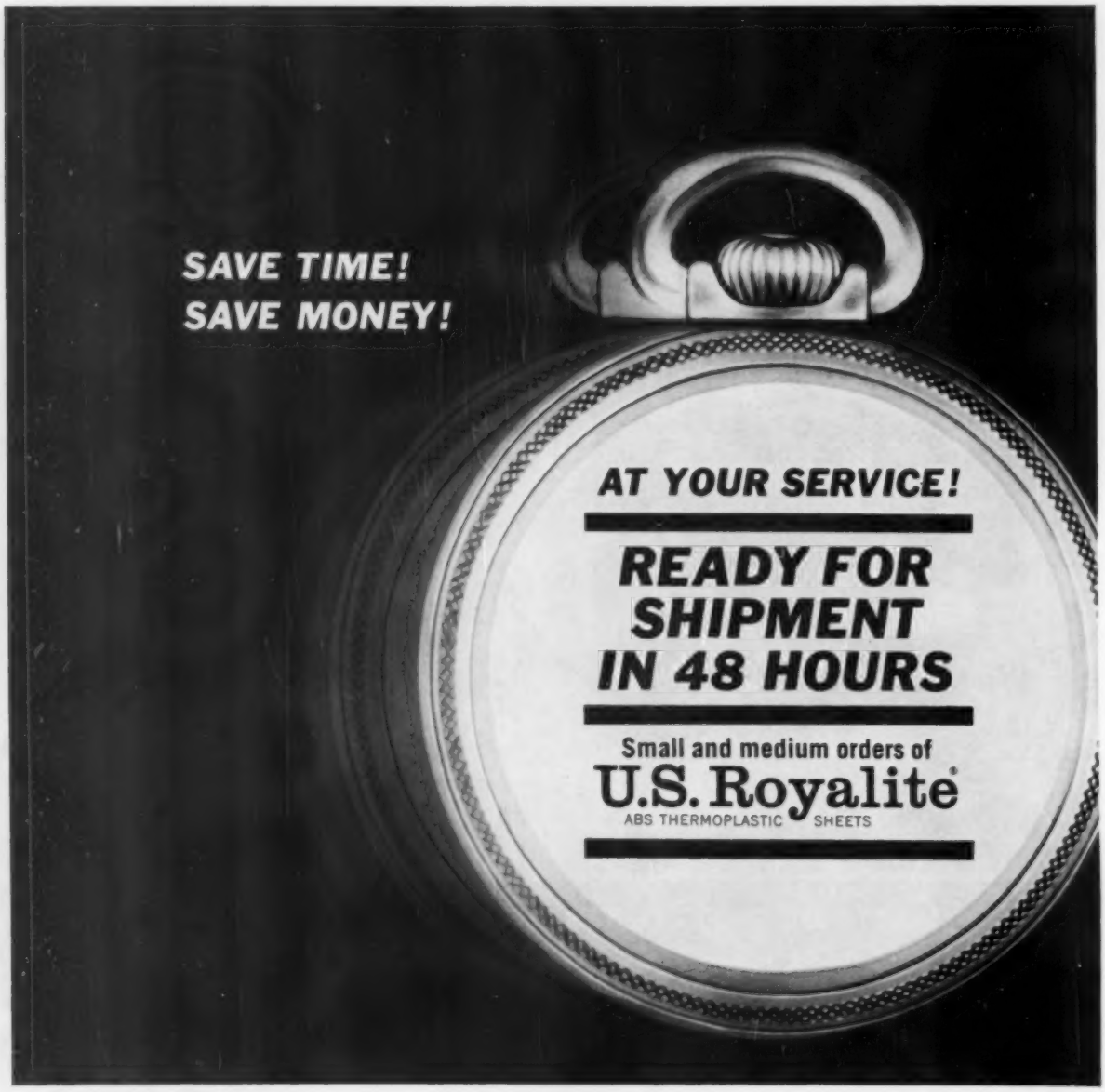

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Rheological study of vinyl calendering compounds

Effects of resin molecular weight, plasticizer concentration, and processing temperature

By W. E. Wolstenholme† and P. E. Roggi‡

The effects of molecular weight and plasticizer content on the rheological properties of polyvinyl chloride compounds at several processing temperatures were studied with the shearing disk (Mooney) viscometer. It was found that the viscometer reading could be predicted with reasonable accuracy by an empirical relation involving molecular weight, temperature, and plasticizer content. This relationship provided quantitative support for a hypothesis on conditions required for optimum calendering of plasticized vinyl compounds. Application of results to other calendering problems are indicated.

The processing characteristics of plasticized polyvinyl compounds result from the combined effects of the physical conditions during processing, such as temperature, speed, clearances, and surfaces of the processing equipment, and of those properties of the processed material that influence the melt viscosity, such as resin molecular weight, plasticizer effect, rate of shear, and activation energy of flow (temperature dependence of viscosity). Excellent progress has been made in understanding the viscoelastic properties of polymeric materials; yet, in industry, it appears that most processing operations on these materials are still more of an art than a science.

The results presented in this report are from a program designed to measure and evaluate the high temperature rheological properties of plasticized vinyl calendering compounds and to apply these results to a better understanding of the practical requirements of calendering processability. This paper deals with the effects of resin molecular weight, processing temperature, and plasticizer content on the rheological or flow properties of commercial vinyl compounds over a range of processing temperatures, and how these results may be applied to calendering. A method for measuring the effectiveness of different types of plasticizers will be presented in a paper to be published at a later date.

The standard Mooney viscometer is well known as an instrument that provides a numerical value indicative of the fluidity or viscosity at constant shear rates and known temperature. Although this instrument was developed and is primarily used for measurements on elastomeric ma-

Table I: Description of vinyl resins

Resin	*Viscosity* — *Specific*	*Intrinsic*	*Molecular weight*
Marvinol[a] MX-2103	0.50	1.25	55,000
Marvinol VR-31	0.44	1.07	48,000
Marvinol VR-23	0.38	0.93	40,000
Experimental	0.36	—	36,000
Marvinol VR-34	0.34	—	35,000
Exon[b] 402-A	0.33	—	34,000
Vinylite[c] QYSJ	0.31	—	31,500
Marvinol VR-24	0.30	0.75	30,000
Marvinol VR-25	0.25	0.70	24,500

[a] Registered trademark of United States Rubber Co.
[b] Registered trademark of Firestone Plastics Co.
[c] Registered trademark of Union Carbide Plastics Co.

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‡ Naugatuck Chemical Div., United States Rubber Co.

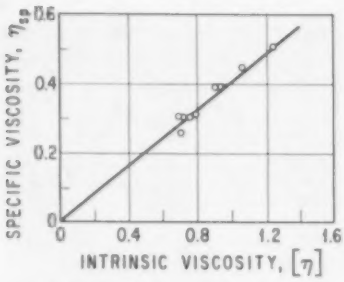


FIG. 1: Comparison of reported specific viscosity of vinyl resins with experimentally determined intrinsic viscosity. Slope of solid line is taken as 0.4. Additional points plotted are from other work.

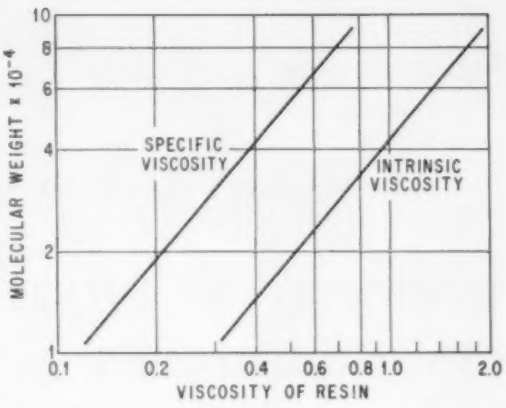


FIG. 2: Estimated molecular weight from specific or intrinsic viscosity of vinyl resin according to relation given by Breitenback, Foster, Renner (2).

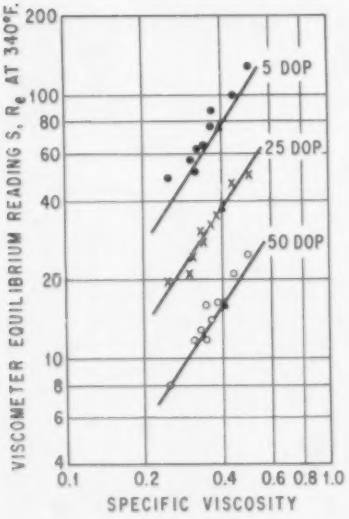


FIG. 3: Effect of plasticizer content on viscometer equilibrium reading at 340° F. with rotor speed of 2 r.p.m. Triangular points and solid line were calculated from Eq. 3, shown on p. 133.

terials, it is rapidly coming into common use for plastics and has been used in our laboratories for several years to obtain viscometric data on many plastics.

For the compounds used in this survey, the standard procedure recommended for Mooney viscometer work with elastomers was modified to avoid overloading the instrument and, also, because reasonable equilibrium readings were not obtainable in the standard 4-min. running period. Vinyl compound samples were preheated from 2 to 4 min. as needed for adequate softening to effect closure of the platens and then were run at 2 r.p.m. until the torque dial reading remained substantially constant, that is, decreased less than one dial division per minute. Shearing time to this working equilibrium state under constant shear varied from 8 to 16 minutes. The Mooney viscometer dial reading recorded under these conditions was taken as a comparative numerical measure of the fluidity that the vinyl compound would exhibit in a processing operation in which the stock would be undergoing constant working at constant temperature, such as in the rolling bank of a calender. All stocks were tested with the standard 1½-in.-diameter serrated rotor. These dial readings have been called constant readings, equilibrium readings, and final readings; in this article such viscometer readings will be referred to as viscometer equilibrium readings and denoted by R_e. Viscometer tests were made at 300, 320, and 340°F.

In addition to the single speed measurements, experimental techniques that were developed for measuring the rheological properties of elastomers at four decades of shear rates were also used on the plasticized PVC stocks. The flow properties of the milled PVC stocks were measured in a multi-speed disk viscometer, which is essentially a standard Mooney viscometer modified to provide a multi-speed range of shear rates from 10^{-2} to 10^{2} sec.$^{-1}$ (rotor speeds approximately from 10^{-2} to 10^{2} r.p.m.). From the torque dial readings at a sequence of rotor speeds, the isothermal flow curve data in terms of absolute rate of shear and shearing stress were computed as described by Mooney (1).[1]

Molecular weights

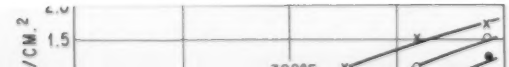
Evaluation of the molecular weight distribution for the nine vinyl resins used in this work was not undertaken. As an approximation for the effect of this factor on flow properties, the weight-

[1] Numbers in parentheses link to references at end of article, p. 200.

Table II: Optimum calendering temperature versus viscometer equilibrium reading (R_e) for vinyl compounds

Marvinol[a] *resin*	*Specific viscosity*	*Plasticizer (Parts DOP)*	*Optimum calendering temperature*	*Calculated* R_e
			°F.	
MX-2103	0.50	50	324	28.6
VR-31	0.44	50	315	28.9
VR-33	0.37	50	305	27.2
MX-2102	0.31	50	295	25.4
			Average	27.7

[a] Registered trademark of United States Rubber Co.



average molecular weight as measured by specific viscosity was used. Specific viscosity values determined in accordance with ASTM D 1243-58T method were available on representative batches of all resins tested. To assess the reliability of the specific viscosity data, measurements of the intrinsic viscosity in cyclohexanone at 30° C. were made on six of the resins. As shown in Fig. 1, p. 132, there was excellent agreement between the specific and intrinsic viscosity values. From the work of Breitenback *et. al.* (2) the relation between molecular weight and intrinsic viscosity is:

$$M = 4.27 \times 10^4 [\eta]^{1.177} \qquad \text{Eq. 1}$$

or using $\eta_{sp} = 0.4[\eta]$, then the molecular weight in terms of specific viscosity will be:

$$M = 1.26 \times 10^5 (\eta_{sp})^{1.177} \qquad \text{Eq. 2}$$

Figure 2, p. 132, permits estimates of the molecular weight from either specific or intrinsic viscosity data.

Formulations

All stocks were formulated and mixed at three plasticizer levels. The formulation used, except as otherwise noted, was:

Ingredient	*Parts by weight*
Polyvinyl chloride resin	100
DOP (dioctyl phthalate)	5,25,50
Thermolite[2] 31	2
Calcium stearate	1

Compounds were preblended cold for 10 min. in a Hobart mixer and then were milled for 10 min. after fluxing on an 8 by 16 in. differential speed mill and sheeted off at 0.100 in. thickness. Compounds with 5 parts DOP were milled at 330° F., 25 parts DOP at 310° F., and 50 parts DOP at 290° F. Resin identification and molecular weight are given in Table I, p. 131.

Viscometer data

In Fig. 3, p. 132, and Figs. 4-5, right, logarithm of the viscometer dial readings is plotted as a function of the logarithm of the specific viscosity for the several test temperatures and plasticizer levels used. The change of viscometer equilibrium readings with molecular weight (as measured by specific viscosity), plasticizer content, and temperature indicated the possibility of a general relationship for the effects of these three variables. An empirical relation from this data was determined and the solid lines drawn through the points on these figures were calculated from the equation:

$$\log R_e = 1.52 \log \eta_{sp} + \frac{2.50 \times 10^3}{T} - 0.0147P - 3.070 \qquad \text{Eq. 3}$$

where R_e is the viscometer equilibrium reading, η_{sp} is the specific viscosity, T is the test temperature in degrees Kelvin, and P is parts by weight of DOP per 100 resin.

In general, Eq. 3 describes the trend and magnitude of the change shown by the data with reasonable fidelity although there is some scattering of experimental values. These variations are attributed to differences such as may occur due to the use of specific viscosity as an estimate of the molecular weight effect on flow and other factors, as yet unknown, that should be included in Eq. 3 to increase its general validity. Extrapolation of Eq. 3 beyond the limits of the experimental results may produce misleading information since other factors not included in this empirical relation may become important in the extended range.

Figure 6, below, and Figs. 7-8,

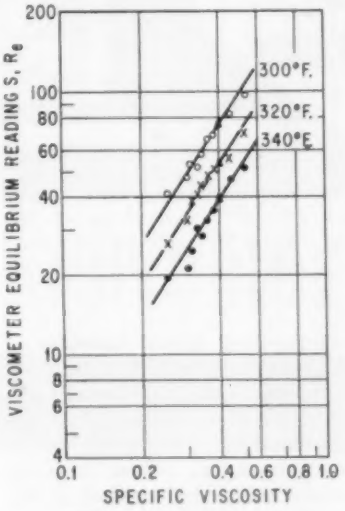
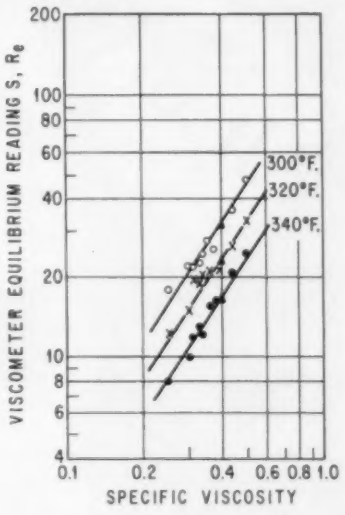


FIG. 4: Effect of temperature on viscometer equilibrium reading with 25 parts of plasticizer in resin. Calculated triangular points and lines were those obtained from Eq. 3, above.

FIG. 5: Similar to Fig. 4, but with 50 parts of plasticizer in resin.



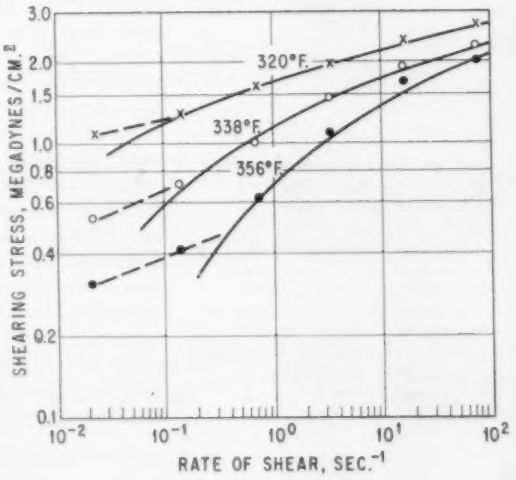


FIG. 6: Isothermal flow data for Marvinol VR-24 and 5 parts DOP. Solid line indicates agreement with master flow curve calculated according to Mooney (1). Departure of experimental points at very low shear rates from theoretical flow is attributed to factors not accounted for by theory.

[2] Registered trademark of Metal and Thermit Corp.

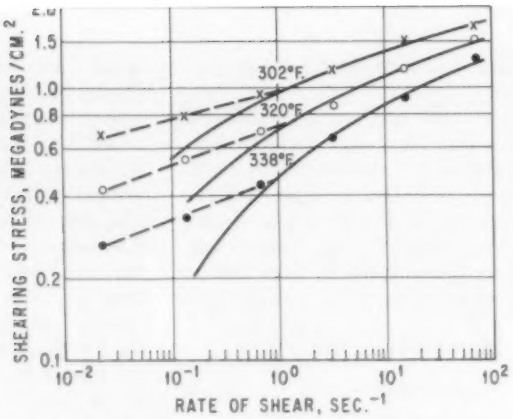


FIG. 7: Isothermal flow data for Marvinol VR-24 with 25 parts DOP and a lower temperature range, otherwise the same as Fig. 6.

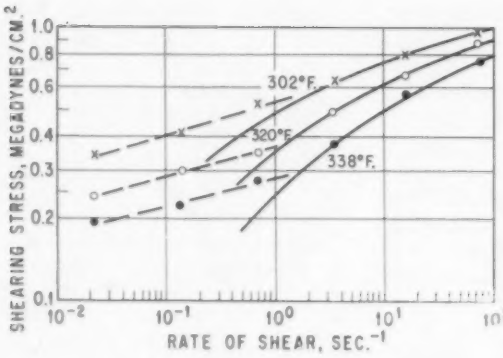


FIG. 8: Isothermal flow data for Marvinol VR-24 with 50 parts DOP, otherwise same as Fig. 7.

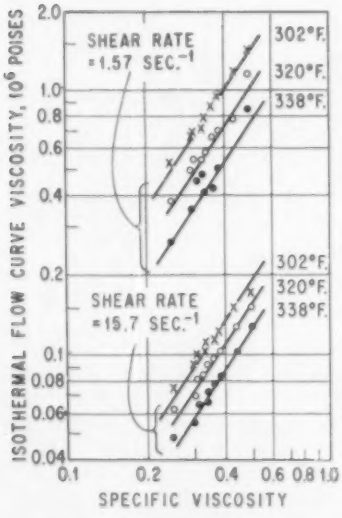


FIG. 9: Dependence of viscosity from isothermal flow curves of resins with 25 parts plasticizer at two levels of shear rates on molecular weight of resin as determined by specific viscosity and temperature. Solid lines have same slope as required by Eq. 3, but effect of shear rate requires modification of other coefficients in Eq. 3.

above, show several examples of isothermal flow curves and the agreement between the experimental points and the generalized (solid line) flow curves. From isothermal flow curves, absolute viscosities can be computed at any chosen rate of shear.

The question naturally arises as to whether the relationship exhibited by the experimental results obtained at viscometer rotor speeds of 2 r.p.m. is altered markedly when the readings are converted to absolute viscosity at the equivalent rate of shear and, of course, how this relationship would change with rate of shear. This has not been determined conclusively because absolute viscosity cannot be calculated from a single viscometer dial reading of the Mooney shearing disk viscometer. However, as an indication of the trend that may be expected over a moderate range of viscosity variation, the absolute viscosities computed from isothermal flow curve data at shear rates equivalent to 2 and 20 r.p.m. of the disk rotor have been plotted as a function of the specific viscosity in Figs. 9 and 10, below. For comparison, the solid line drawn through the points in these figures is of the same slope as used in Eq. 3. These plots show that in the range of rotor speeds from 2 to 20 r.p.m., the absolute viscosities at the equivalent shear rates exhibit a similar dependence on the three independent variables used in Eq. 3.

Application of rheological data

The relationship found in this viscometry work appears to have potential use in both research, development, and factory processing. The effects of molecular weight and plasticizer content on the flow behavior at processing temperatures can be estimated by the methods used herein. Estimates of the molecular weight of a vinyl resin can be obtained from a Mooney viscometer reading at specified conditions and reference to an established plot of viscometer reading as a function of specific or intrinsic viscosity, or molecular weight.

By the use of the relationship exhibited by these data it has been possible to test a hypothesis, advanced by us, that optimum processing of vinyl compounds is achieved when the stocks are processed within a certain narrow range of absolute viscosity. This means that **(To page 198)**

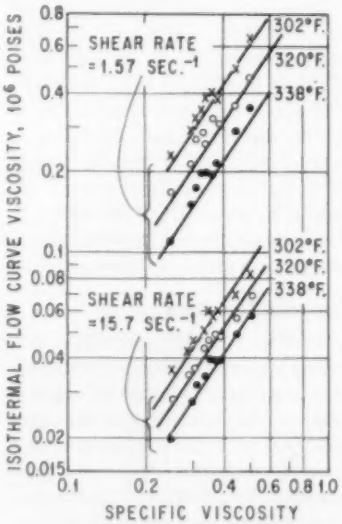


FIG. 10: Similar to Fig. 9, but with resins containing 50 parts plasticizer.

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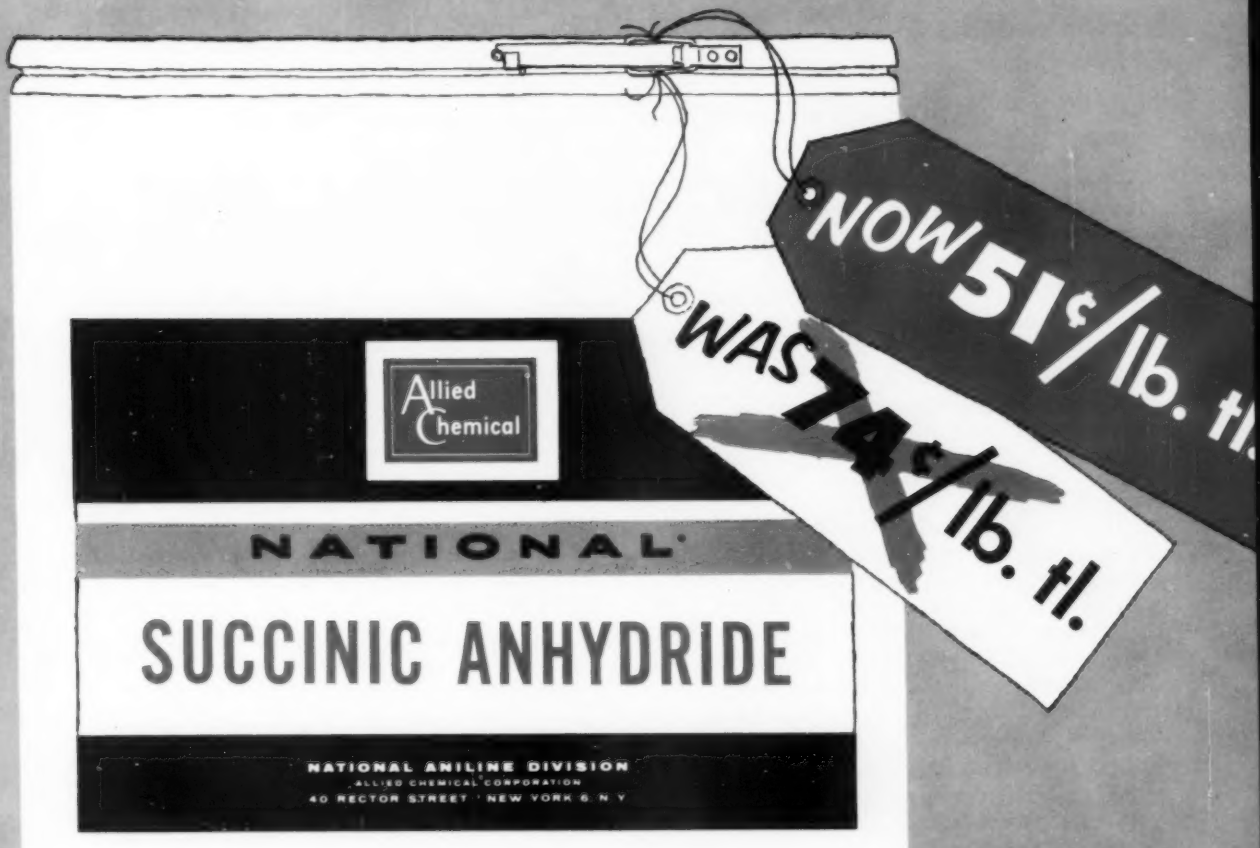

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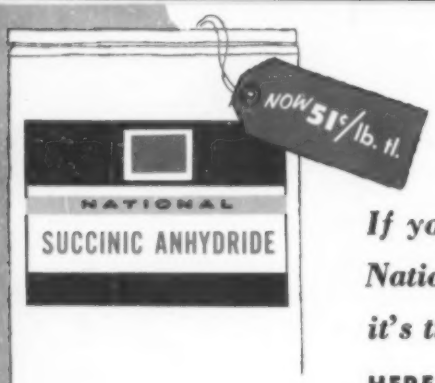

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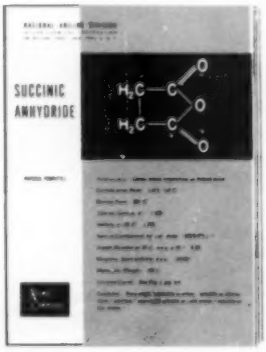

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Olefin and terpene epoxides

Novel reactive diluents for epoxy resin formulations

By R. J. Gall*, J. J. Rizzo†, and H. M. Castrantas*

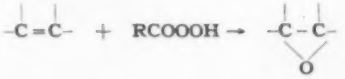
Since the commercial introduction of epichlorohydrin in 1946 (1),[1] the use of epoxy resins (condensation products of epichlorohydrin and bisphenol A) has steadily increased, and, at the present time they have become an integral part of the thermosetting resin scene.

With the ever increasing uses and applications for these materials, it has been found necessary to alter or at least modify the basic resin structure in order to meet specific needs. This has largely been accomplished by varying the degree of polymerization, curing agents, cure cyles, reactive and nonreactive diluents, flexibilizers, fillers, pigments, etc.

The purpose of this paper is to describe one of these modifications—the use of olefin and terpene oxides as reactive diluents for epoxy resin formulations. The earliest used reactive diluents were the glycidyl ethers and styrene oxide. These were prepared by hypochlorination followed by dehydrohalogenation (2). These diluents are currently available alone or in combination with the epoxy resins.

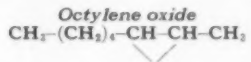
With the commercial availability of highly concentrated hydrogen peroxide and peracetic acid and the development of epoxidation as a unit process (3,4,5), a large number of epoxy chemicals have become available. Multimillion pounds of these products are currently being used by numerous manufacturers as epoxy plasticizers for polyvinyl chloride as well as its copolymers.

These epoxides are prepared by the oxidation of alkenes with an organic peracid, preformed or prepared *in situ*.

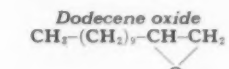


The structures of the olefin and terpene epoxides are as follows:

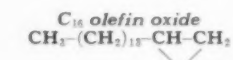
Octylene oxide



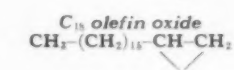
Dodecene oxide

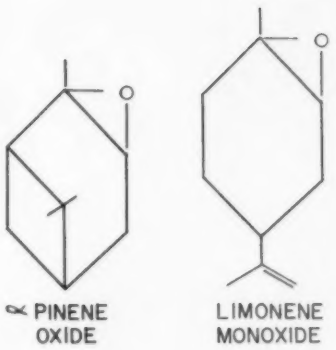


C_{16} olefin oxide



C_{18} olefin oxide





Octylene oxide or 2,3-epoxyoctane has the oxirane oxygen in the 2,3 position. The dodecene oxide and mixed C_{16}-C_{18} olefin oxides have the oxirane oxygen in the 1,2 or terminal position. The mixed oxides contain 60% **(To page 140)**

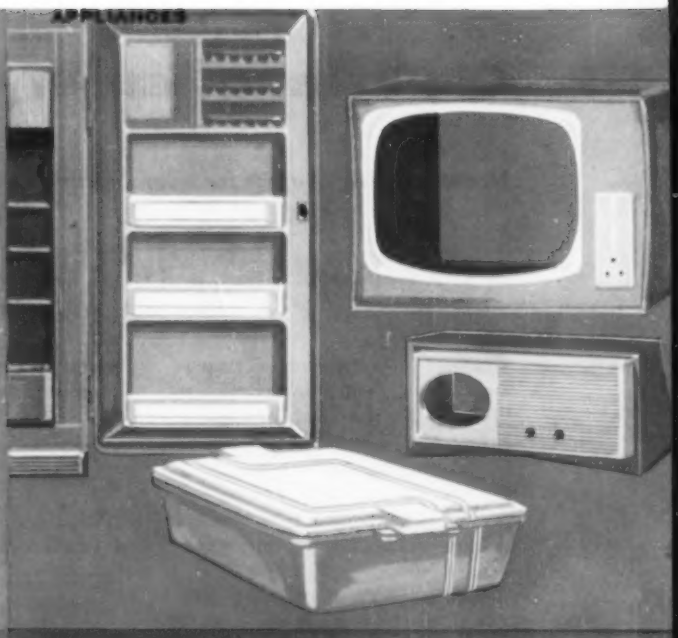
Table I: Physical properties of olefin and terpene oxides

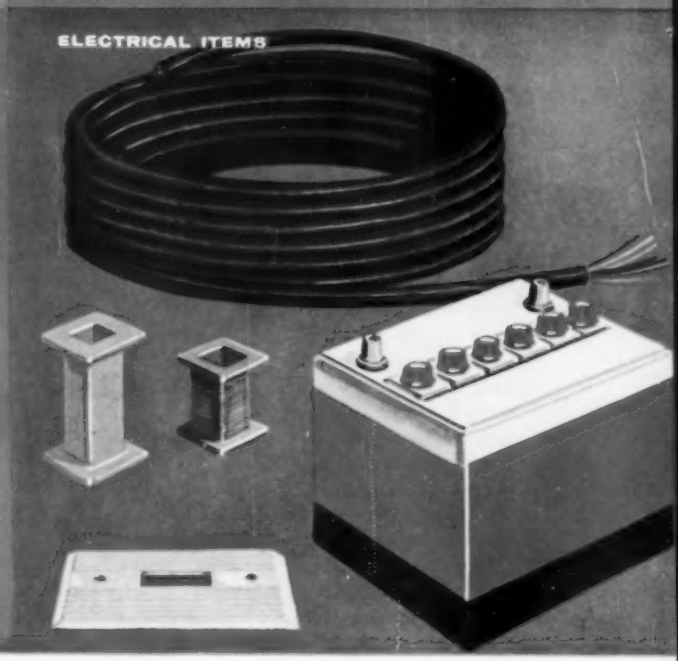
Properties	*Octylene oxide (2,3-epoxy octane)*	*Dodecene oxide*	*C_{16}–C_{18} olefin oxide (60% C_{16}–40% C_{18})*	*Limonene monoxide*	*α-Pinene oxide*
Assay, %	95	90	90	90	90
Molecular weight[a]	128	184	245[b]	152	152
Freezing point, °C.	Below —50	—11	—14	Below —60	Below —60
Boiling point, °C/760 mm. (extrapolated)	156	215	300	172	178
Flash point (Tag closed cup), °F.	110	>208	>208	152	132
Weight (lb./gal.)	6.9	6.9	7.0	7.7	8.0
Viscosity at 25°C., cp.	2.5	4.1	7.2	4 8	5.6
Epoxy value (eq./100 g.)	0.74	0.48	0.35	0.55	0.59

[a]Of the pure epoxides.
[b]Based on average composition of the mixture.

*Present address: Inorganic Research & Development Dept., Food Machinery & Chemical Corp.
†Present address: Chemicals & Plastics Div., Food Machinery and Chemical Corp.
[1]Numbers in parentheses link to references at end of article, p. 203.
Contribution from Becco Chemical Div., Food Machinery & Chemical Corp., based on a paper presented at the Upper Midwest S.P.E. RETEC, Oct. 21, 1958.

AUTOMOTIVE AND AIRCRAFT PARTS HOUSEWARES AND TOYS





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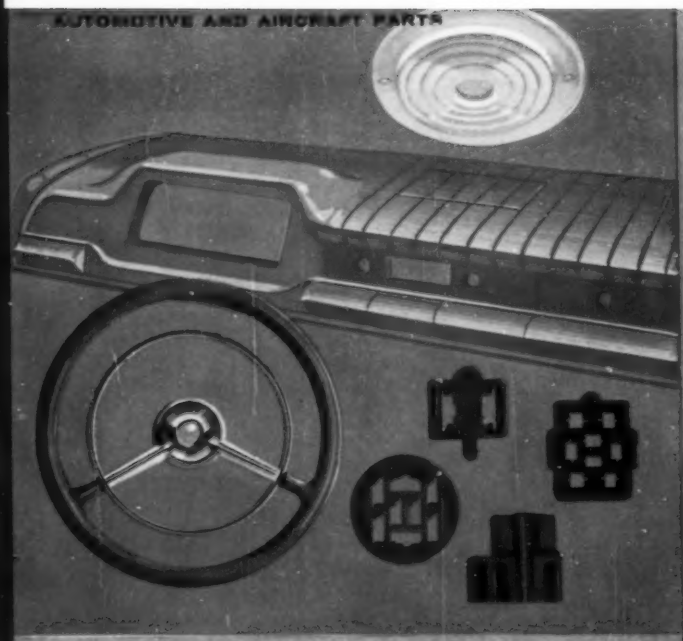

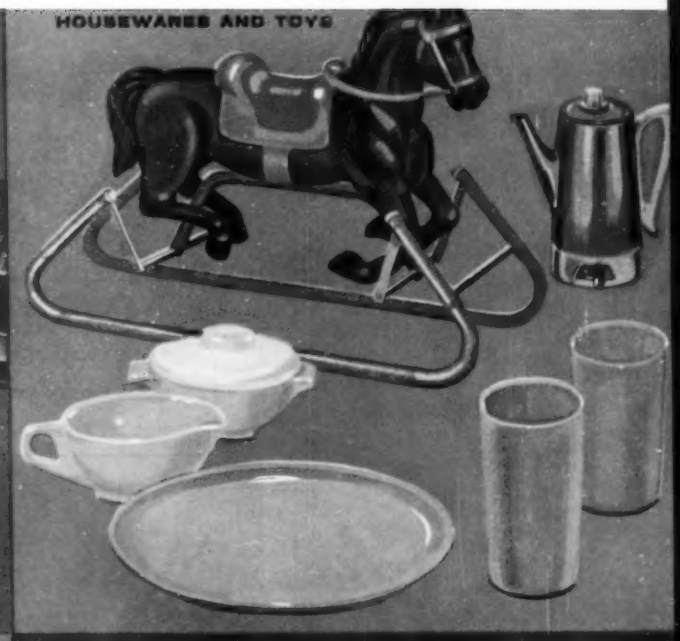

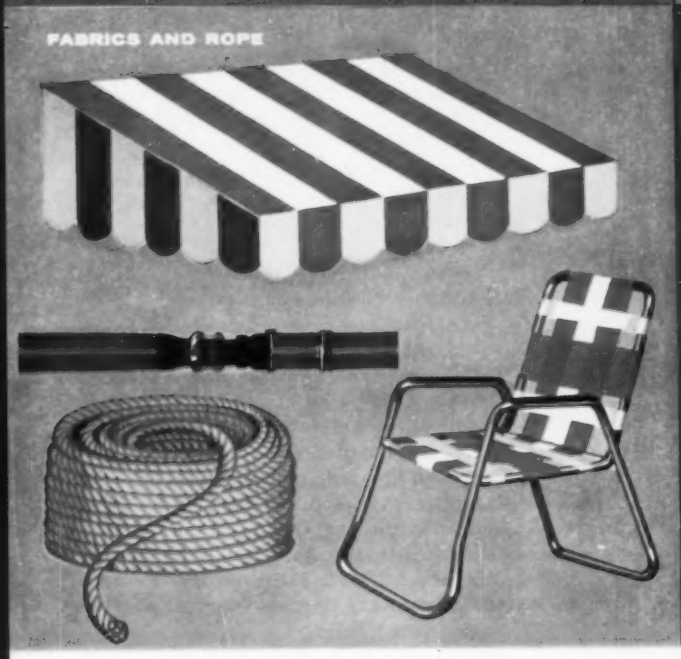

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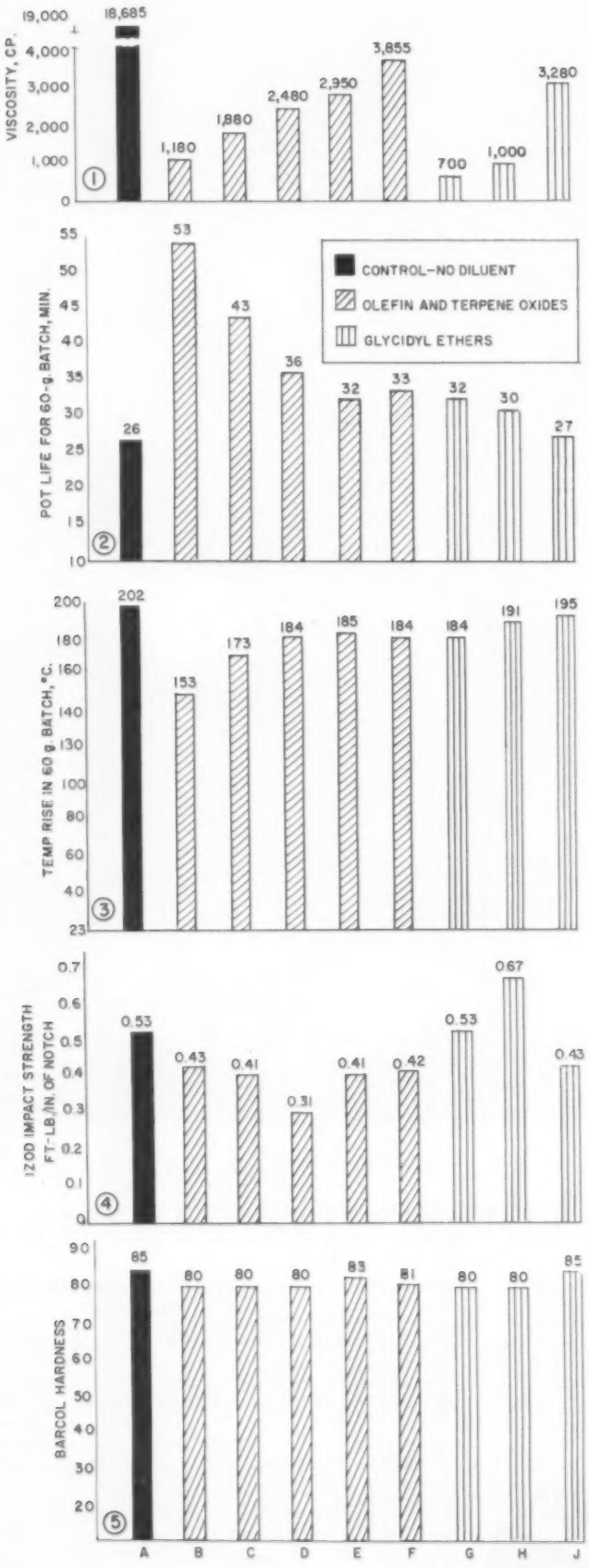

of 1,2-epoxyhexadecane, 40% of 1,2-epoxyoctadecane. In the limonene monoxide, a cyclic terpene molecule, is found a ring epoxide and an external double bond. The α-pinene oxide possesses a ring epoxide on a bicyclic molecule.

The physical properties (6) for the olefin and terpene oxides are shown in Table I, p. 137. The assay for the olefin and terpene oxides is 90% and above. The boiling points increase with increasing molecular weight from 156 to 300° C. at 760 mm. (extrapolated). The density of these products, expressed as pounds per gallon, varies from 6.9 for octylene oxide to 8.0 for α-pinene oxide. The low viscosity exhibited by these oxides is most interesting. The epoxy values are in the range of 0.35 to 0.74, and are in proportion to the molecular weight of the oxides.

The olefin and terpene oxides exhibit a low order of toxicity. Table II, p. 142, summarizes these results. The oral toxicity of the olefin and terpene oxides is approximately the same, slightly toxic, except for the C_{16}-C_{18} olefin oxide which is practically non-toxic in single oral doses. With the exception of α-pinene oxide, all these epoxides are classified as practically non-toxic when administered intraperitoneally to rats. Only the C_{16}-C_{18} olefin oxide exhibits moderate or severe skin irritation in rabbits. Although limonene monoxide and α-pinene oxide produce severe reactions in the eye, C_{16}-C_{18} olefin oxide is without significant irritant effect. No fatalities or untoward effects were observed among rats inhaling the octylene and terpene oxide vapors. Due to their low toxicity no cases of

FIG. 1: Effect of reactive diluents on viscosity at 25° C. of an epoxy casting resin. **FIG. 2:** Effect of reactive diluents on pot life at 23° C. of an epoxy casting resin. **FIG. 3:** Effect of reactive diluents on maximum exotherm of an epoxy casting resin. **FIG. 4:** Effect of reactive diluents on Izod impact strength of an epoxy casting resin. **FIG. 5:** Effect of reactive diluents on Barcol hardness of an epoxy casting resin. **A**—Control; **B**—Octylene oxide; **C**—Dodecene oxide; **D**—C_{16}-C_{18} olefin oxide; **E**—Limonene monoxide; **F**—α-Pinene oxide; **G**—Allyl glycidyl ether; **H**—Butyl glycidyl ether; **J**—Phenyl glycidyl ether.

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sensitization have been reported as a result of handling the olefin and terpene oxides in the laboratory or pilot plant.

The evaluation of these olefin and terpene oxides as reactive diluents in amine-cured epoxy resin formulations for castings and coatings will be described in this paper.

Table II: Toxicity of the olefin and terpene oxides[a]

Toxicity	*Octylene oxide*	*Dodecene oxide*	*C_{16}-C_{18} olefin oxide*	*Limonene monoxide*	*α-Pinene oxide*
Oral	Sl. T.	Sl. T.	Pr. N.T.	Sl. T.	Sl. T.
Intraperitoneal	Pr. N.T.	Pr. N.T.	Pr. N.T.	Pr. N.T.	Sl. T.
Skin	Mild-mod.	Mild-mod. (delayed)	Mod.-severe	Mild	Mild
Eye	Mild-mod.	Mod.	N.I.	Mod.	Severe
Inhalation	No △	——	——	No △	No △

[a]Code for abbreviations:
Sl. T. — Slightly toxic.
Pr. N.T. — Practically non-toxic.
Mod. — Moderate.
N. I. — No irritation.
△ — Change or effect.

Castings

By far the largest volume of reactive diluents is being used in epoxy resin castings (7). These diluents are free-flowing liquids that are used not only to modify the resin but also to reduce its viscosity so that better penetration in castings may be achieved and higher filler contents may be utilized. Reactive diluents (containing epoxy groups or other reactive groups) become an integral part of the resin during the curing cycle and are preferred for this reason. Diluents are generally used in amounts ranging from 5 to 20 parts per 100 parts of resin (PHR) by weight.

A typical casting resin of molecular weight 350 to 400 with an epoxide equivalent of 175 to 210 was used with 10 parts of reactive diluent and 10.6 parts of diethylenetriamine (DETA), unless otherwise stated. Using this base formula, the effects of the olefin and terpene oxides on the viscosity, pot life, exotherm, heat distortion temperature, Izod impact strength, water absorption, tensile strength, and Barcol hardness were determined. Results are compared with those obtained with the reactive glycidyl ether diluents (allyl, butyl, and phenyl) and with a control having no diluent.

The reduction in viscosity determined for the various formulations, using a Brookfield Viscometer, is shown in Fig. 1, p. 140. The viscosity of the resin system increases with increasing chain length in the olefin oxide series; the latter systems are lower in viscosity than those containing the terpene oxides.

Casting resin pot life values, determined with 60-g. batches of resin in an uninsulated paper cup, are shown in Fig. 2, p. 140. An increase in chain length in the olefin oxide series results in decreasing pot life. The pot life of the octylene oxide modified system is about double that of the control. The terpene oxides give values about equivalent to the glycidyl ethers.

The maximum exotherms of the control and modified castings are shown in Fig. 3, p. 140. The temperature was recorded by means of a thermocouple placed in the center of a 60-g. batch of resin contained in an uninsulated paper cup. An increase in chain length in the olefin oxide series means higher maximum exotherms. Terpene oxide values are about same as those for glycidyl products.

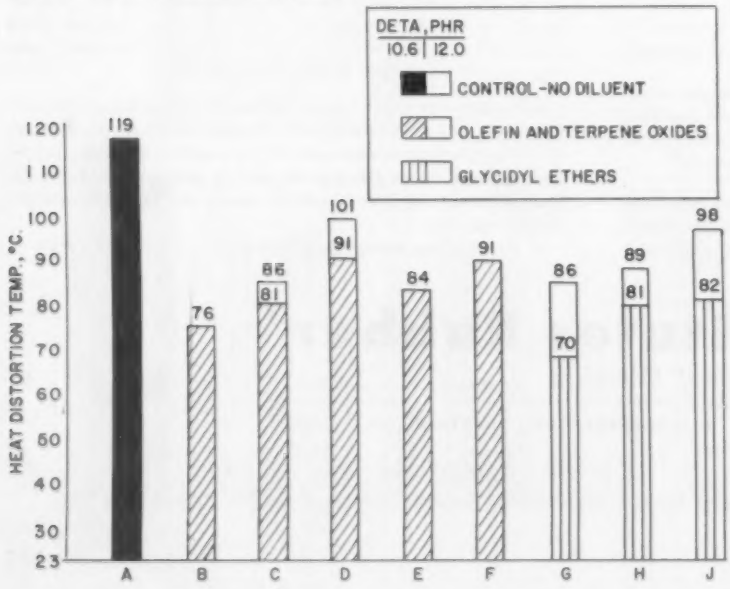
For many of the physical tests, bar and sheet specimens are required. The bars were prepared by casting the modified resin in aluminum molds sized with silicone fluid diluted with toluene. Sheets were cast by pouring the resin mixture between two glass plates sized with silicone fluid and separated by a polytetrafluoroethylene sheet spacer. The castings were cured for 20 hr. at 23° C., followed by 2 hr. at 100° C. in a forced circulating air oven, conditioned, and tested.

Notched Izod impact values (ASTM D 256) of the control and modified castings are found in Fig. 4, p. 140. Impact values are in same range (0.31 to 0.53) with the exception of the butyl glycidyl ether modification (0.67).

No significant difference in Barcol hardness (Fig. 5, p. 140) is found among modified castings.

As indicated in Fig. 6, left,

FIG. 6: Effect of reactive diluents on heat distortion temperature of epoxy casting resin. Letter designations same as Figs. 1-5, p. 140.



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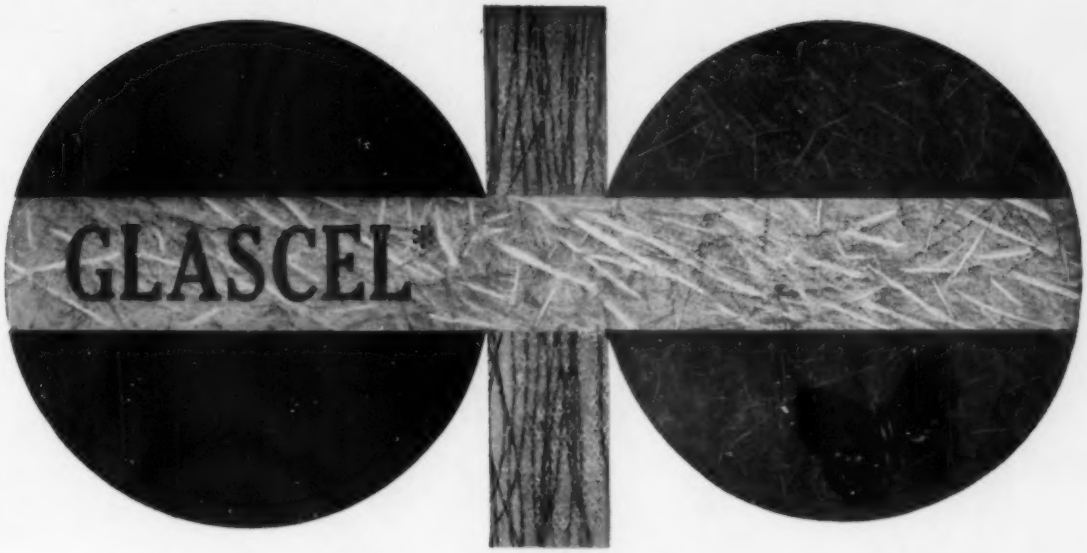

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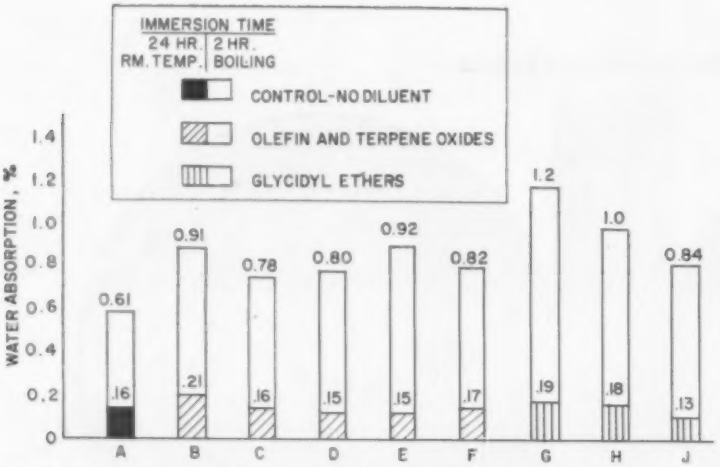


FIG. 7: Effect of reactive diluents on water absorption of an epoxy casting resin. Letter designations same as for Figs. 1-5, p. 140.

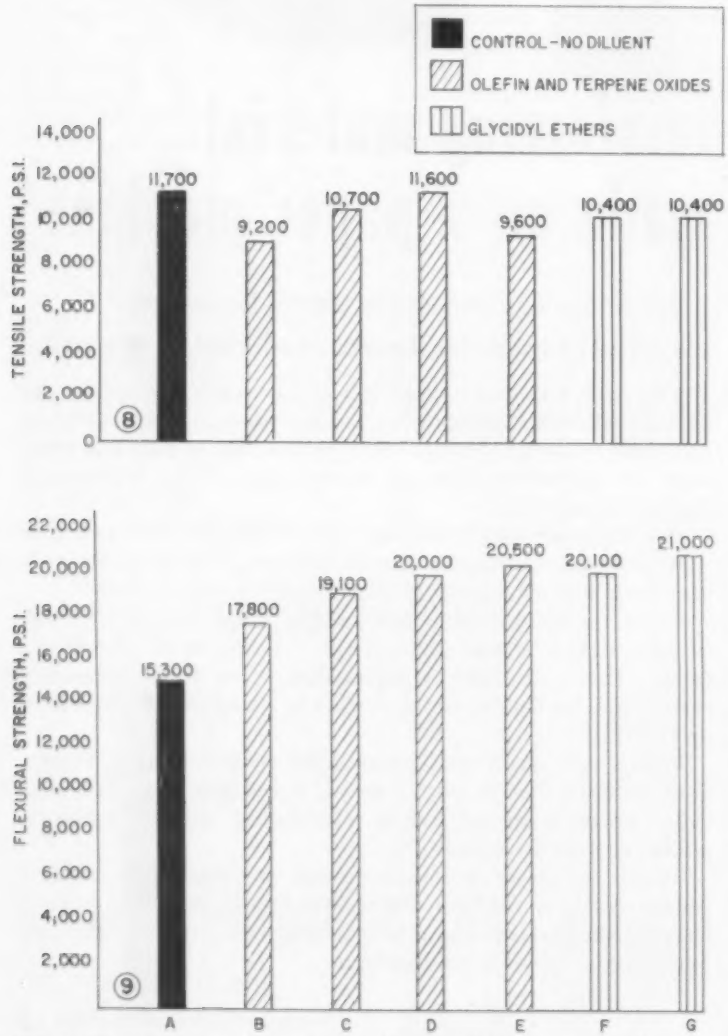


FIG. 8: Effect of reactive diluents on tensile strength of an epoxy casting resin. **FIG. 9:** Effect of reactive diluents on flexural strength of an epoxy casting resin. **A**—Control; **B**—Octylene oxide; **C**—Dodecene oxide; **D**—Limonene monoxide; **E**—α-Pinene oxide; **F**—Allyl glycidyl ether; and **G**—Butyl glycidyl ether.

a spectrum of heat distortion temperatures (ASTM D 648, 264 p.s.i.) is obtained with the olefin and terpene oxides and 10.6 PHR of the amine curing agent. Octylene oxide yields the lowest heat distortion temperature, 76° C., whereas the highest, 91° C., is recorded for the C_{16}-C_{18} olefin oxide and α-pinene oxide. Increasing the amine content to 12.0 PHR does not increase the heat distortion temperatures of castings containing octylene oxide, limonene monoxide, or α-pinene oxide. It does, however, increase the heat distortion temperatures of castings containing the terminal epoxides, i.e., the dodecene and C_{16}-C_{18} olefin oxides as well as the glycidyl products. The epoxy resin modified with the C_{16}-C_{18} olefin oxides has the highest heat distortion temperature, 101° C.

The water absorption values (ASTM D 570) are shown in Fig. 7, above. Castings containing the olefin and terpene oxides along with the control and glycidyl products exhibit approximately equivalent absorption values (0.13 to 0.19%) in the 24-hr. room temperature test. Higher and more varied values are obtained upon immersion in boiling water for 2 hr. (0.61 to 1.2%).

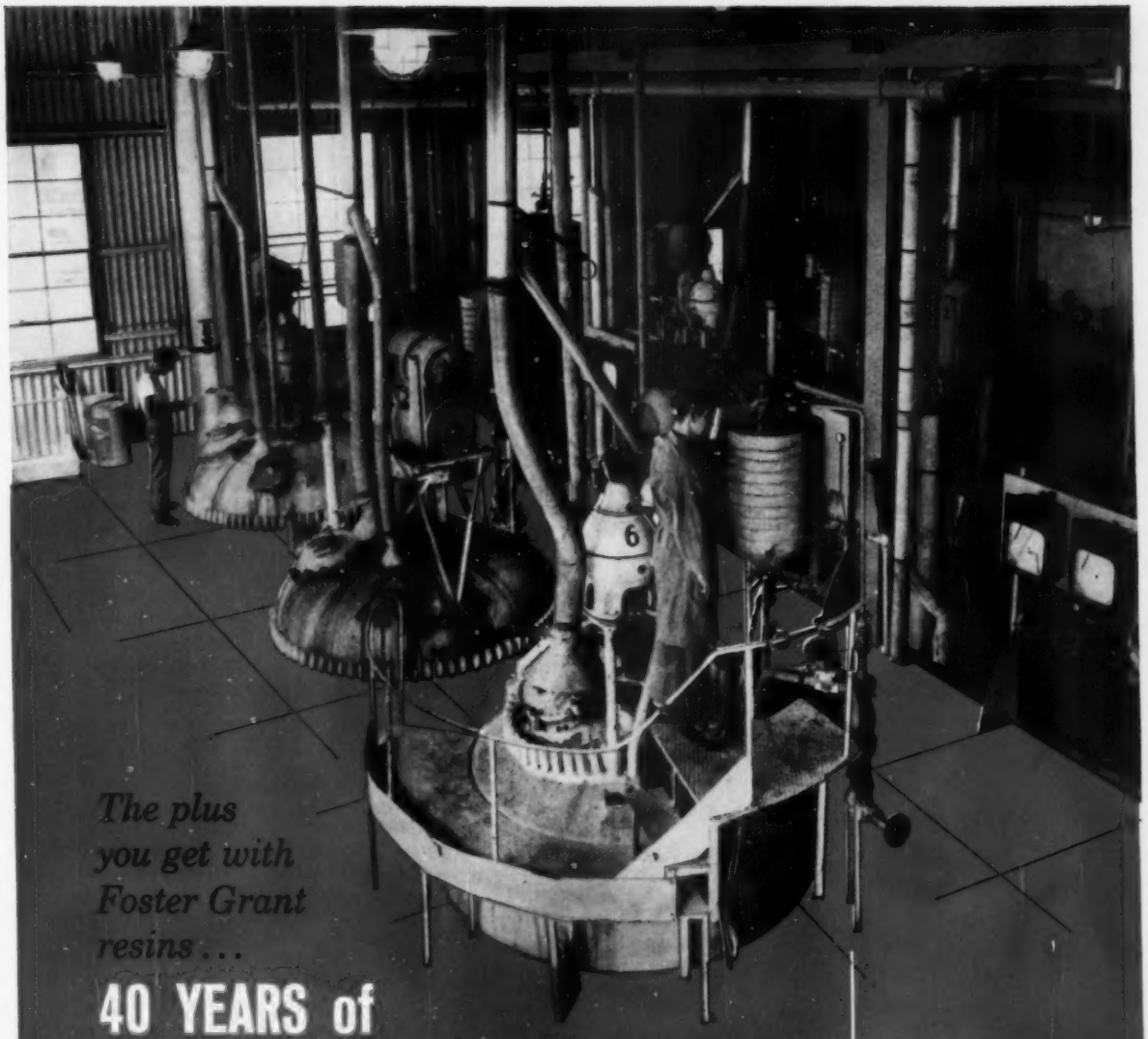
The tensile strength values (ASTM D 638) are shown in Fig. 8, left. Tensile strength values of the modified castings are slightly lower than the control.

The flexural strengths (ASTM D 790) are shown in Fig. 9, below. Modification with reactive diluents increases the flexural strength from 15,300 to 21,000 p.s.i.

Coatings

While reactive diluents have not been widely used in epoxy resin coatings, reference to this use appears in the literature (8). Since these products confer desirable properties upon the modified casting resins, the investigation was extended to include an evaluation of these diluents in epoxy-amine solution coatings.

The formulations used in this work are shown in Table III, p. 148. Coatings containing olefin and terpene oxides are compared to a control containing no reactive diluent and formulations containing glycidyl **(To page 148)**



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HERCULES Plastics Hi-Lites

Vol. II, No. 1

New plastics are the big story in today's modern appliances

INSIDE OR OUT, PRO-FAX® APPLIES—a real performer, Pro-fax! It's built to stand up to the most rugged use challenges whether they be indoors or outside. As a result, this newest of plastics—Hercules polypropylene—has been finding increasing use in appliances that call for the finest in appearance and performance. Tough, rigid, heat-resistant, hard to stain, Pro-fax is richly colorful and the lightest plastic ever.

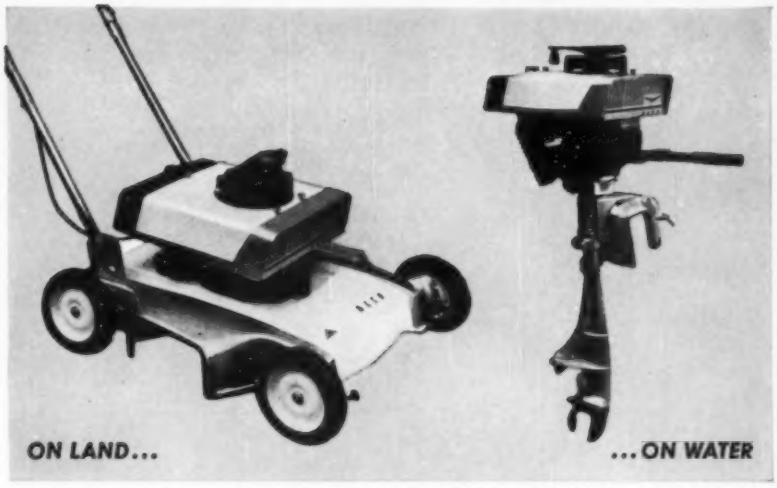
Pro-fax has opened up a whole area of new thermoplastic usage. Now designers have at their command a structural material that can often be used to replace more costly raw materials. Easy to mold, Pro-fax can be used to produce precision-formed units at low cost. It's little wonder that so many of the nation's leading appliance manufacturers are turning to Pro-fax to help solve production problems, and to give added values to their products.

A TRIPLE PLAY BY PRO-FAX

This Triple Duty Filter Dispenser, an exclusive feature found in all Philco-Bendix "Automagic" washers, is another example of the advanced engineering made possible by the proper use of such new plastics as Pro-fax polypropylene. Exploded view (left) shows the six injection-molded parts which make up the assembly of this compact, highly functional unit. Removable cap and cup shown at top are polyethylene. The remainder of the unit consists of four precision-molded Pro-fax parts which are ingeniously joined to form the body of the dispenser filter. The dispenser lid is permanently joined to the upper half of the body by spin-welding, while the lower half is attached by self-tapping screws. The removable filter trap (at bottom) has a molded bayonet-type catch, with an insert-molded metal mesh filter. Pro-fax was selected for this demanding assignment because of its outstanding resistance to detergents and chemicals, and its ability to withstand prolonged exposures to high temperatures. Lightweight; a handsome, colorful finish; and resistance to breakage are other features of the new unit. And of course the producer enjoyed all the important processing bonuses provided by Pro-fax, including more parts per pound, and dimensionally stable, precision fitting components.

Instantly accessible when the washer is open, Philco's Triple Duty Dispenser serves three important functions in the washing cycle. The entire tub of water is filtered six times a minute to remove all traces of lint. It provides automatic detergent dispensing at any preselected water level, insuring even dispersion; and it automatically dispenses clothes conditioner at the proper time to assure a softer, cleaner wash.

Molded by Seneca Plastics Company, Cambridge, Ohio.



DOUBLE PLAY BY ACCO

The new Acco "Outboard Mower" is not only an industry first, but one of the first big new merchandising ideas of many a year. It's a power mower with a motor that can be removed and attached to a propeller unit to make a powerful outboard motor. The conversion can be effected in minutes, and on land or water the motor is protected at all times by a colorful, durable housing molded with Pro-fax. Pro-fax proved the only plastic with all the requirements demanded by this new concept in dual-purpose equipment: lightweight, rigidity, resistance to heat, chemicals and staining, plus a lustrous surface finish that bespeaks quality merchandise.

Molded by Research Plastics, Inc., Jersey Shore, Penna.

A HIT BY REGINA

This attractive, low-cost plastic accessory is certain to be a hit with homemakers who own a Regina Polisher-Scrubber. Waxing is no longer a chore with this new automatic dispenser unit. Fingertip control assures uniform distribution of wax, avoiding waste and yielding professional results without splashing or stooping. For the ultimate in appearance and performance in this new appliance accessory, Regina selected Pro-fax. In addition to providing lightweight strength in a handsomely styled unit with a colorful, stain-proof finish, Pro-fax supplies the excellent sealing qualities needed for a leak-proof seal, plus resistance to wax solvents such as turpentine.

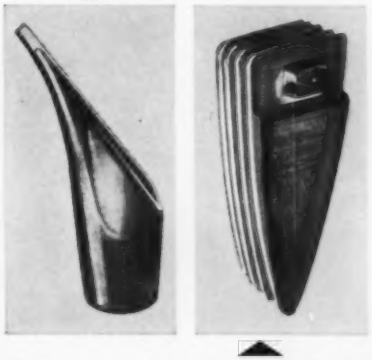
The new Pro-fax pump unit is easily attached to the Regina Polisher-Scrubber handle. When not in use, it will not hamper normal operation.

Pump unit molded by Ideal Plastics Division, Ideal Toy Corporation, Long Island, New York.

Design Hi-lites

The dramatic change-over by producers of light-duty liquid detergents to blow-molded plastic bottles has focused new attention on a long-established processing technique. Blow-molding is one of the oldest of plastic arts, and designers have long been intrigued by the intricate shapes and unusual forms which can be achieved by this method. Until recently, however, materials adaptable to blow-molding lacked the structural and functional characteristics required to yield rigid structures suited to a wide range of uses. The advent of such new plastic materials as Hi-fax, high-density polyethylene, has changed this picture to the point where blow-molding has now become the fastest growing sector of our industry.

Permitting the use of undercuts, blow-molding can achieve intricate shapes impossible by other methods. Modern version of classic vase in design below could serve as watering can, condiment bottle, or medicinal container. Sketches by Sundberg-Ferar.



Blow-molded Hi-fax containers can be designed with a "bellows" action in packages that serve as pumps or dispensers. Design shown above is for a household deodorant or insect spray container.

The sketches shown here are but two of the many exciting and different product ideas shown in a new Hercules film-strip, "Something New in Packaging." If you'd like to see this up-to-date report on a new industry and the materials which serve it, write or call us. It will take only minutes of your time, may put your new products years ahead.

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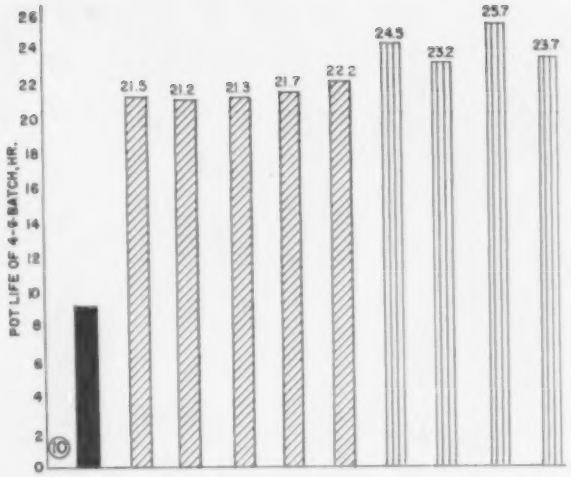

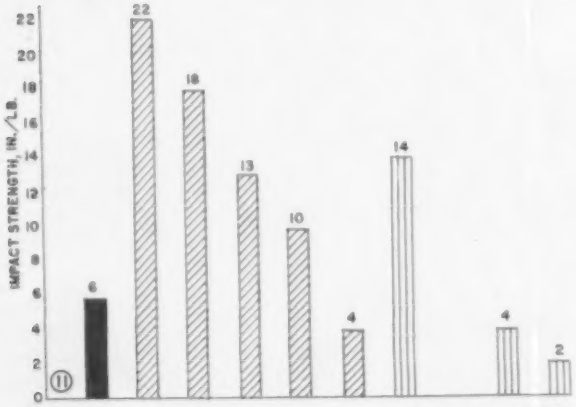

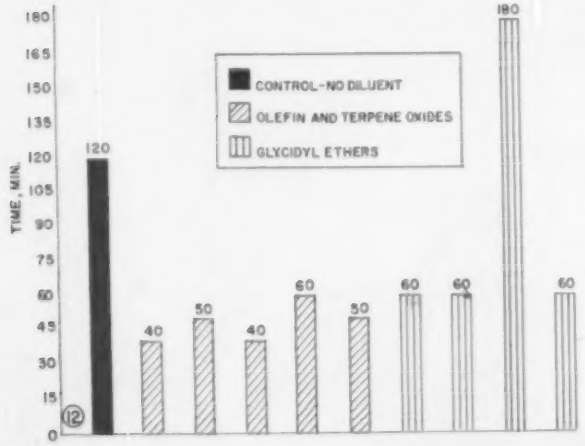

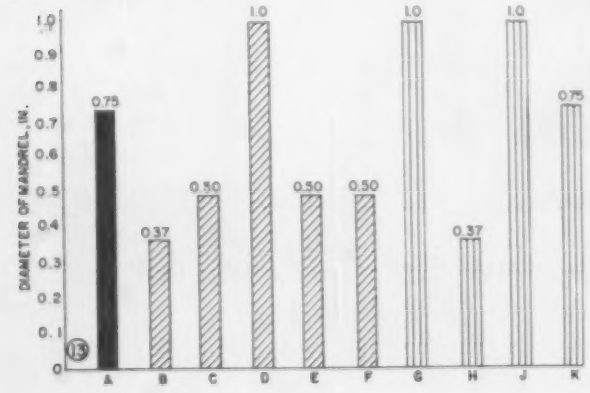

Table III: Epoxy coating formulations (parts by weight)

Materials	*Control*	*Modified coatings*
Epoxy resin	58.2	52.4
Reactive diluent	—	5.8
Urea-formaldehyde leveling agent	1.8	1.8
Xylene	13.6	13.6
Methyl isobutyl ketone	13.2	13.2
Cellosolve	13.2	13.2
Diethylene-triamine	3.6	3.6

ethers and styrene oxide. In these formulations, a typical coating resin of molecular weight 900 to 1000 with an epoxide equivalent of 450 to 525 was used. The concentration of reactive diluent, amine, leveling agent, and mixed solvents remained constant.

All constituents of the coating solution except the diethylenetriamine were dissolved first. After solution occurred, the diethylenetriamine was blended in and the solution aged 2 hr. at room temperature. Application on glass plates or steel and tin panels was made with a Gardner ultra applicator. An additional 2 hr. room temperature aging was employed in order to reduce pinholing during the bake cure. The average thickness of the coating was 3 mils. The tack-free time of 3-mil coatings containing the reactive diluents was 6 to 8 hours.

The pot life values for the control and modified coatings are shown in Fig. 10, above. Uninsulated 4-g. batches of epoxy resin solution contained in glass vials were used. The modified coatings exhibit a substantial increase in

FIG. 10: Effect of reactive diluents on pot life at 25° C. of an epoxy coating solution. **FIG. 11:** Effect of reactive diluents on impact strength of an epoxy coating. **FIG. 12:** Effect of reactive diluents on time at 93.3° C. for epoxy coating to attain maximum impact strength (160 in./lb.). **FIG. 13:** Effect of reactive diluents on flexibility of an epoxy coating. **A**—Control; **B**—Octylene oxide; **C**—Dodecene oxide; **D**—C_{14}-C_{16} olefin oxide; **E**—Limonene monoxide; **F**—α-Pinene oxide; **G**—Allyl glycidyl ether; **H**—Butyl glycidyl ether; **J**—Phenyl glycidyl ether; **K**—Styrene oxide.

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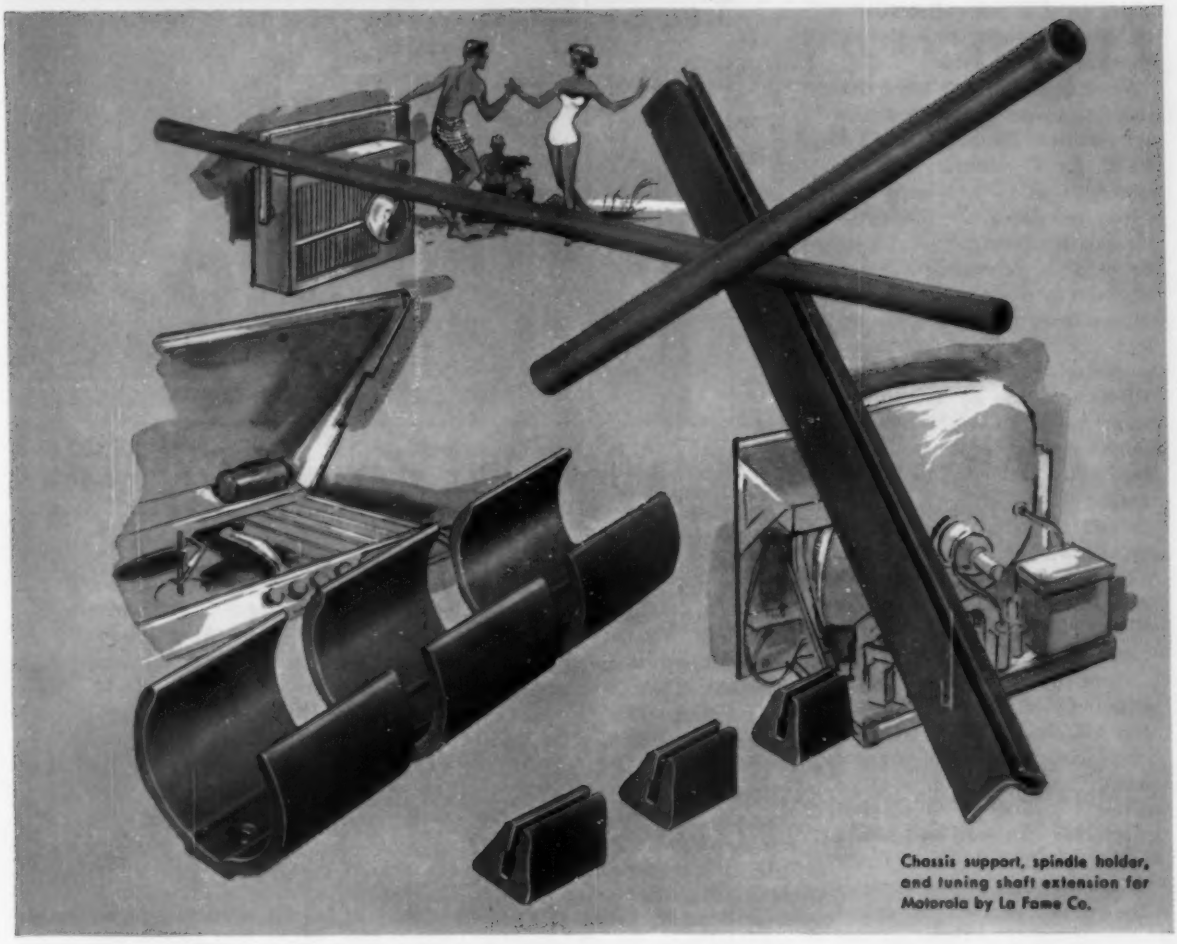

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pot life (21.2 to 25.7 hr.), more than double that of the control (9.5 hr.). Contrary to their effect in a casting resin, the coatings containing the olefin and terpene oxides have a somewhat shorter pot life than those with glycidyl ethers or styrene oxide.

Taber abrasion tests were conducted on epoxy coatings containing reactive diluents cured at 93.3°C. for 40 minutes. This test employed CS-15 wheels under 1000 g. load per wheel for 500 cycles at room temperature conditions. The order of decreasing abrasion resistance is olefin oxides ≅ control ≅ styrene oxide > terpene oxides > glycidyl ethers. Values for the control and modified coatings (0.0148 to 0.0188 g.) are similar except for a coating containing phenyl glycidyl ether which is significantly inferior in Taber abrasion (0.0346 g.).

Impact strengths of a series of epoxy-amine coatings, determined by the Gardner Variable Impact tester, are shown in Fig. 11, p. 148. The coatings were baked for 20 min. at 93.3°C. and aged 24 hr. at room temperature. Coatings containing olefin oxides, limonene monoxide, and allyl glycidyl ether have higher values of impact strength than the control or other modified coatings. The impact strength of the octylene oxide modified coating is four times greater than that of the control.

The time required to attain maximum impact values for the control and modified epoxy-amine coatings is shown in Fig. 12, p. 148. Modification of the coatings with the reactive diluents, with the exception of phenyl glycidyl ether, lowers by about 50% the time required to attain maximum impact strength. Coatings containing the olefin oxides and α-pinene oxide are particularly effective in this regard.

The flexibility values of the control and modified epoxy-amine coatings are shown in Fig. 13, p. 148. These values were determined by bending a 3-mil film coated on a tin panel over a series of steel mandrels of decreasing diameter, at a rate of 10 sec. to travel 180 degrees. The diameter of the mandrel on which the coating exhibited cracking or strain lines was taken as the flexibility value. The coatings were baked for 20 min. at 93.3°C. and aged 0.5 hr. at room temperature. The octylene oxide and butyl glycidyl ether modifications give the most flexible coatings, 0.37 versus 0.75 for the control.

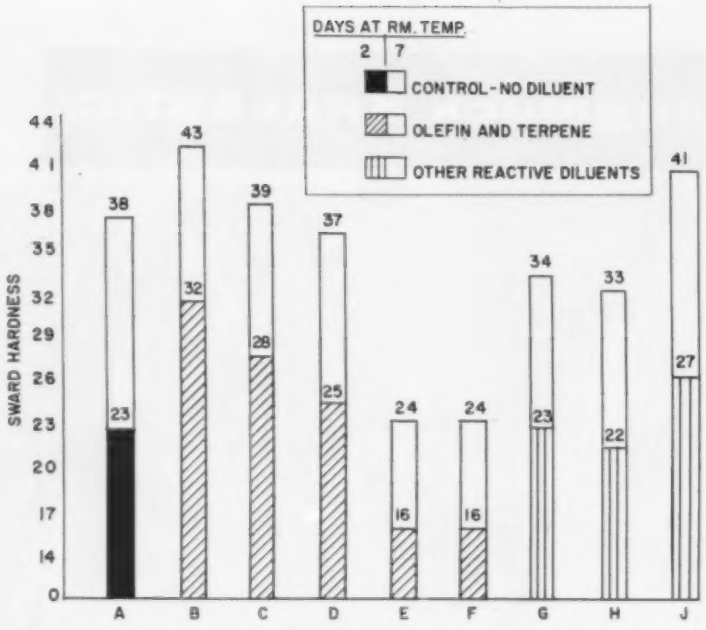


FIG. 14: Effect of reactive diluents on Sward hardness on aging of an epoxy coating. **A**—Control; **B**—Octylene oxide; **C**—Dodecene oxide; **D**—C_{16}-C_{18} olefin oxide; **E**—Limonene monoxide; **F**—α-Pinene oxide; **G**—Allyl glycidyl ether; **H**—Phenyl glycidyl ether; **J**—Styrene oxide.

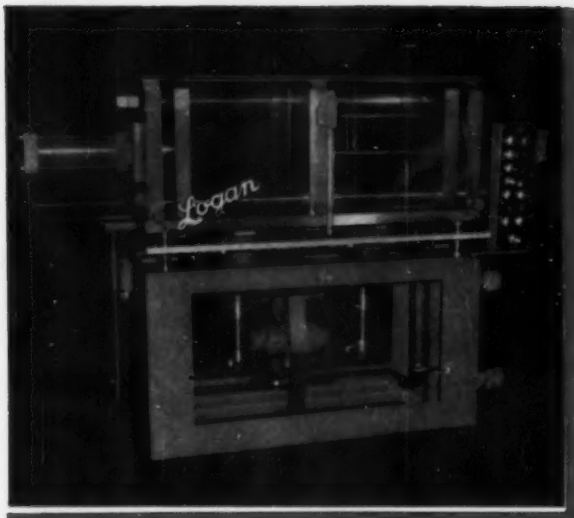
Sward hardness values for coatings cured at room temperature are shown in Fig. 14, above. After 2 days the octylene oxide modified coating possesses the highest hardness value, 32, followed by those with dodecene oxide, styrene oxide, and the C_{16}-C_{18} olefin oxides in that order. All are higher than the control. The glycidyl products are equivalent to the control, 23, and the same general pattern holds true with the octylene oxide modification reaching a hardness of 43. The slower cure rate of coatings containing the terpene oxides is shown by their lower values of Sward hardness.

The results of tests for chemical and solvent resistance of the coatings cured at room temperature and 93.3°C. indicate that those containing the olefin oxides offer resistance similar to that of the control; 70% sulfuric acid, 30% nitric acid, 28.7% ammonium hydroxide, toluene, and methyl isobutyl ketone were used in these tests. The resistance of the coatings containing the terpene oxides is not satisfactory. Acid cures may prove to be more effective with this class of reactive diluents. Coatings containing the glycidyl ethers and styrene oxide are intermediate between those containing olefin and terpene oxides.

In a preliminary adhesion test, the control and modified epoxy-amine coatings, cured both at room temperature and 93.3°C. and crisscrossed with ⅛-in. squares, were subjected to low pressure steam for 15 min. followed by cold water for 1 minute. The cycle was repeated until adhesion failure occurred. The coatings containing the C_{16}-C_{18} olefin oxides retain their adhesion over a greater number of cycles than the others.

Summary and conclusions

The properties of the olefin and terpene oxides and their use as reactive diluents for amine-cured epoxy resin castings and coatings have been reviewed. These oxides when used in epoxy resin castings are characterized by the following advantages: 1) low order of toxicity, 2) reduction of viscosity, 3) increased pot life, 4) lower exotherm, and 5) increased flexural strength. The impact, water absorption, tensile strength, and hardness are not adversely affected. Actually, **(To page 203)**



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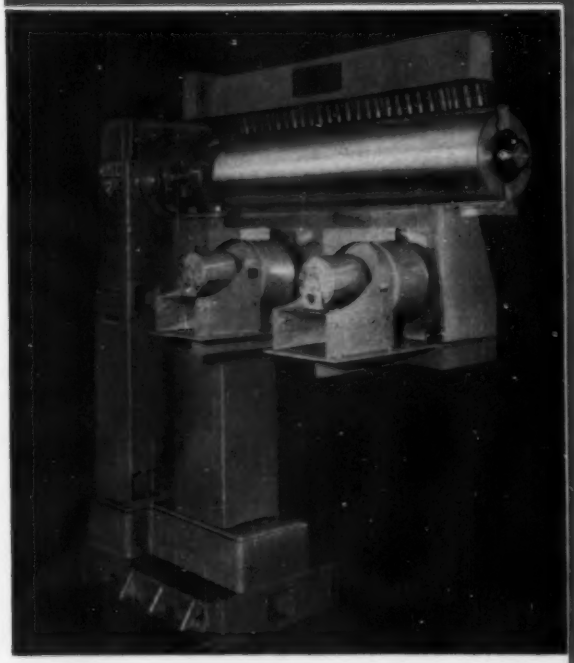

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Evaluation tests for plastics heels

By E. E. Joiner*, J. P. Szumski*, and F. J. McGarry*

Various thermoplastics, including acrylics, cellulosics, and styrenes, were used in tests involving large numbers of production-run high-style heels, molded on commercial equipment and submitted to factory grading, finishing, covering, and other operations. Three tests were employed: impact strength, nailing, and flexural fatigue resistance. Used continually for both quality control and evaluation of new materials, these tests have proved remarkably informative, correlate directly with field service, are economical to perform, and require simple equipment and easily trained personnel. The tests permit controlled studies of materials and processing variations, the effects of shoe manufacturing operations, and proper reinforcement techniques.

The use of plastics in heels for women's shoes has experienced a remarkable expansion in the past several years. Cellulosics, modified acrylics, impact styrenes, polyethylene, and numerous other types and blends of polymers have been employed in this application, and a wide variety of materials can be found in such service at the present time. Because of the rate at which this expansion has taken place and the almost unlimited number of material compositions potentially applicable, however, confusion has arisen with respect to selecting the best material for a heel design.

Compounding this difficulty has been a strong trend toward thinner and higher style heels on the part of shoe designers, apparently in response to consumer preferences, which seriously lessens the value of early field experiences with plastics heels and places increased emphasis on the ability and judgment of the heel producer. Finally, the economic pressures in this application are intense because of the large number of units involved and the multiplicity of production sources that are available.

It is the purpose of this paper to describe experience in developing laboratory tests to evaluate plastics heel design and materials in terms of predicting subsequent field service on shoes. In addition, the necessity for quality controls in large scale production is apparent and constitutes a second, equally important application of the tests. Obviously, the use of such tests, if they are valid, is far more economical and prudent than reliance upon field tests, since the latter are very expensive and difficult to control.

In the development of the tests, two principles were observed: the tests would be performed with actual heels rather than conventional test bars or strips, and the tests would simulate the worst possible service conditions that the heels would normally be expected to encounter. Heels rather than test bars were chosen because of several factors. For its mass, a heel is an unusually thick section molding, with great changes in geometry over relatively short distances. It is made in a multi-cavity mold on commercial machines with flow and heat transfer conditions virtually impossible to reproduce in a smaller, experimental set-up.

Variations from cavity to cavity and from machine to machine are to be expected; hence many heels, a large sample population, are imperative, requiring simple tests quickly performed. Finishing operations such as annealing, grading, lacquering, covering, and attaching have different influences on a heel and on a test bar because of the different prior histories that the material undergoes during molding. It should be mentioned in this respect that the use of rapid drying lacquers containing strong organic solvents, while

FIG. 1: Heel test specimen.

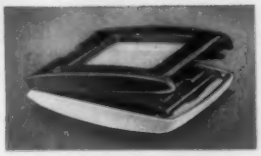
Table I: Impact strengths of injection molded heels

Plastic	Impact strength of unlacquered heels		Impact strength of lacquered heels	
	No dowel	Dowel[a]	No dowel	Dowel[a]
	ft./lb.	ft./lb.	ft./lb.	ft./lb.
Butyrate	10	25	8	23
Modified acrylic	7	30	2	26
Impact styrene	3	24	1	24

[a] Vitalift reinforcing dowel (made by F. W. Mears Heel Co. Inc.).

*Exec. Vice-Pres.; Dir., Development and Engineering; and Consultant, respectively, for Fred W. Mears Heel Co. Inc.

Based on a paper presented at the Society of Plastics Engineers Regional Technical Conference in St. Louis, Mo., Nov. 1959.



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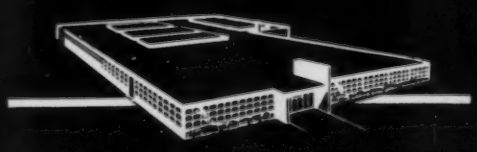

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FIG. 2: Impact tester shown here, which is a modified Izod machine, is used for impact strength evaluation of plastics heels.

perhaps necessary because of production rate requirements, may cause severe damage to the plastics heel and make annealing imperative for consistency of quality and the reduction of this damage.

In use, the heel is exposed to several severe effects. The attachment operation of the heel to the shoe uses a device designed for wooden heels, which imposes a sudden and large clamping force, more or less along the heel axis. Unskilled operators on piecework rates cannot be expected to adjust the clamping force for different heel materials and sizes so that many plastic heels are partially yielded and mechanically damaged in the operation.

Evidence of this can often be found through a slight bulging or ridge in the narrowest section of the heel stem caused by the local compressive buckling failure and flow of the material. This is accentuated and its later bad effect heightened by improper treading of the heel to the shoe upper. Treading refers to the angle that the axis of the heel makes with the supporting surface when the shoe wearer is standing motionless; on a properly fitted shoe this should be 90°, and variations as small as ± ½° cause surprisingly large cyclic bending stresses in the heel, resulting in accelerated wear or fatigue failure. Such fatigue on material previously yielded in attaching has been responsible for many of the heel failures to date since the concept of properly tread heels for each shoe style and size, previously economic with wood, is not thought to be compatible with the costs of injection molds.

Another characteristic of the heel involves the toplift which, until very recently, was simply nailed to the heel. Blunt end brads, unfortunately inherited from wooden heel practice, are rapidly driven with appreciable force and necessitate that the nonporous plastic material be quickly displaced without gross fracture, since three nails in a very small area are simultaneously inserted. Here, skin effects such as solvent crazing from the lacquer or residual stresses from molding can be critical since local

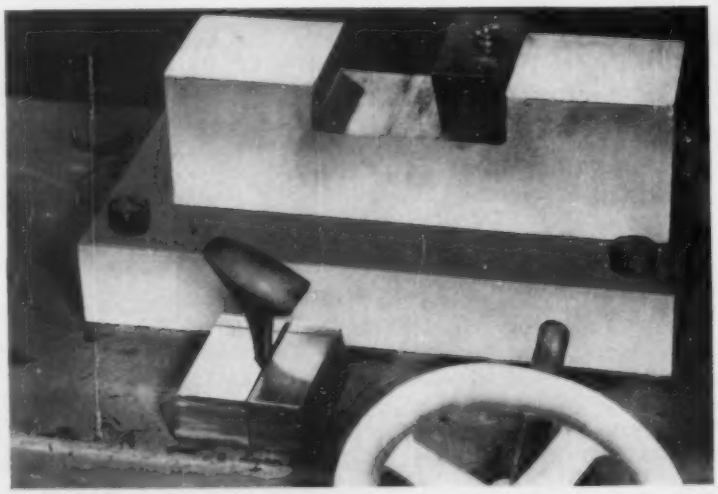

FIG. 3: Heel clamp and vise for impact tester.

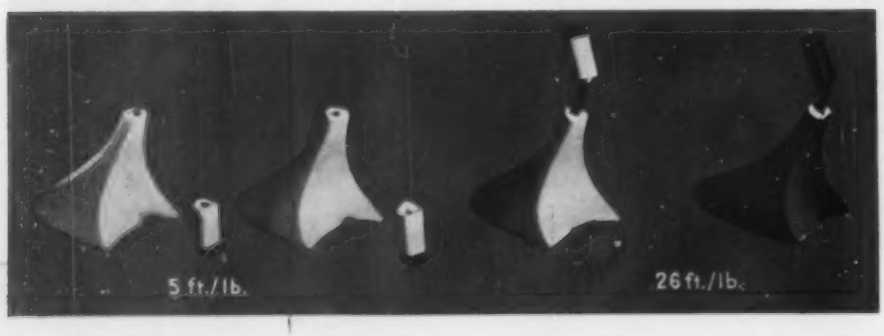

FIG. 4: Impact tested heels showing variations in reinforcement effectiveness.

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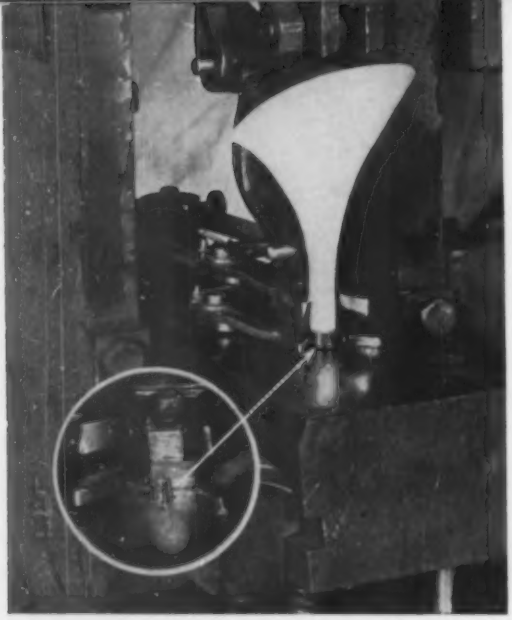


FIG. 5: Nailing tester. Inset shows brads used in test.

splitting from nailing is often a delayed action, not occurring until several days or weeks after the operation is carried out. Also it must be kept in mind that the cobbler may be called upon to replace toplifts several times during the normal wearing of the shoes.

Previous experience with wooden heels forcefully demonstrated the importance of impact strength considerations in their design. With the advent of plastics, reputedly a much superior class of materials in this respect, it was felt that the problem would be largely eliminated. However, high style designing and some of the previously mentioned fabricating effects, especially the use of solvent based lacquers, rendered this expectation invalid and in many ways the present plastics heels are comparatively inferior in impact resistance unless reinforced with a metallic insert.

For comparative purposes, only the results of tests on heels of the type shown in Fig. 1, p. 152, referred to as style E-25, will be discussed in this paper; it is high style and representative of the many designs popular at present.

Impact strength

The earliest plastics heels were stout enough in design so that the superior impact properties of the material constituted a genuine advance over the wooden heel. Style changes and the increasing price competition, which discouraged care in material formulation, molding, annealing and lacquering, dissipated this advantage, however; at the present time impact strength and stiffness requirements in high style heels such as the E-25 can be adequately met only by the use of a steel reinforcing dowel.

The apparatus used for impact strength evaluation, a modified Izod machine, is shown in Fig. 2, p. 154. Figure 3, p. 154, shows in some detail the holder in which the heel is located. The capacity of this machine is 120 ft./lb. and its scale can be read accurately to 1 ft./lb. After some experimentation, an initial pendulum energy of 40 ft./lb. was established as satisfactory to ensure failure of even all-metal heels, making possible the gathering of data such as that presented in Table I, p. 152 in which several representative materials are compared.

This test, as well as the other two being described, is sensitive to and has been used to study the effects of molding and annealing conditions, material and lacquer formulations, and reinforcement. For example, the quality and condition of the steel used as a reinforcing dowel are important in that if they are not properly controlled, the dowel is not effective in strengthening the heel. This is illustrated in Fig. 4, p. 154, which shows that a strong ductile dowel gave the combination an average impact strength of 26 ft./lb. and that an inadequate, brittle dowel broke at 5 ft./lb., both used with a material that has an unreinforced impact strength of 3 ft./lb. Obviously the modest improvement derived from the improper dowel does not justify the additional cost associated with its use.

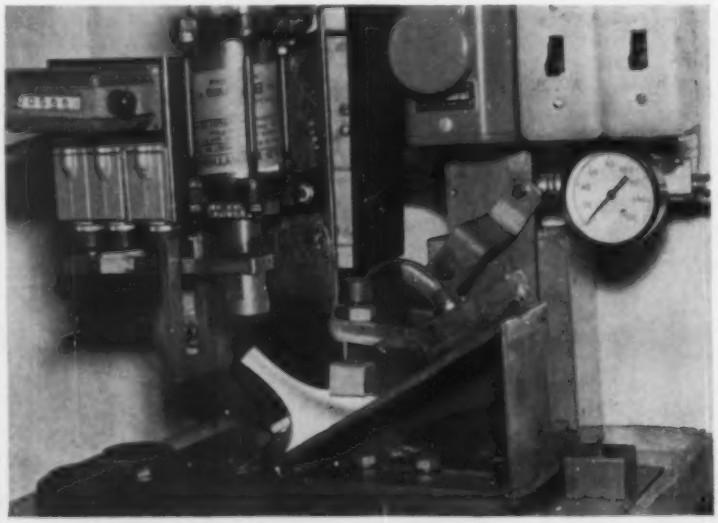
With brief training, unskilled personnel can perform 75 to 90 impact tests per hour, thus making possible comprehensive impact studies of the parameters mentioned, as well as quality control testing, at reasonable expense.

Nailing test

Apparatus shown in Fig. 5, above, a commercial machine[1] for shoe production, constitutes the nailing tester. Care **(To page 204)**

[1] Manufactured by W. J. Young Mfg. Co., Lynn, Mass.

FIG. 6: Flexural fatigue tester.



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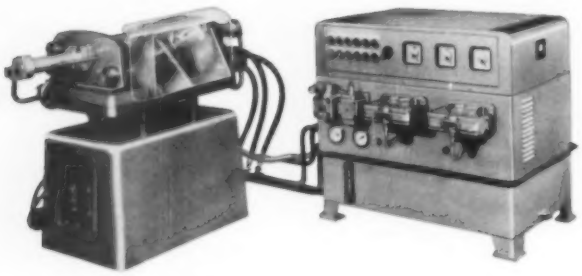

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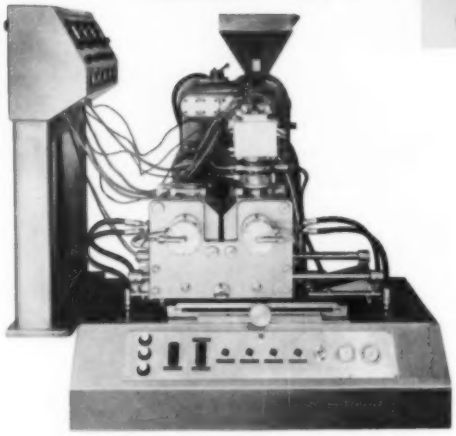

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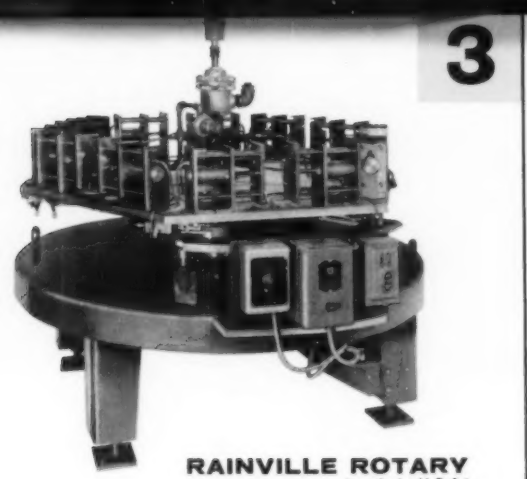

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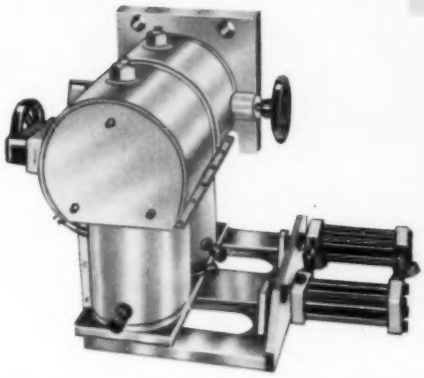

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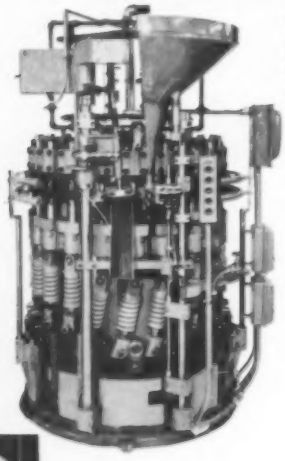

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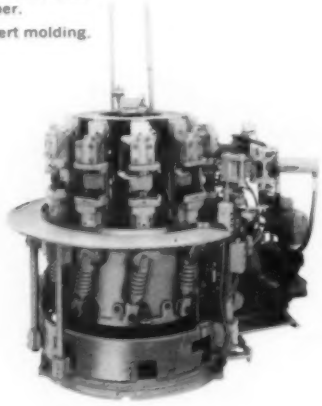

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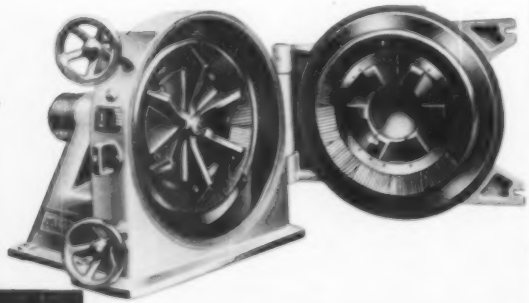

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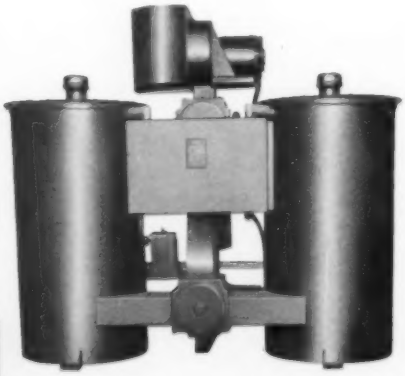

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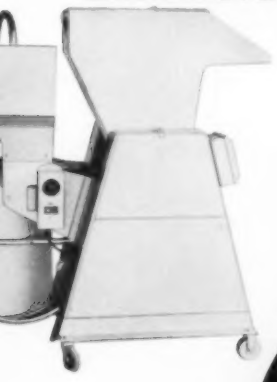

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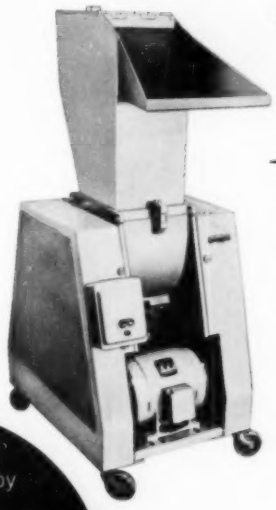


Model	HP	Throat
HD-1	3	8½ x 10
HD-1F	5	8½ x 10
HD-2	5	10 x 14
HD-2F	7½	10 x 14

Manufactured by

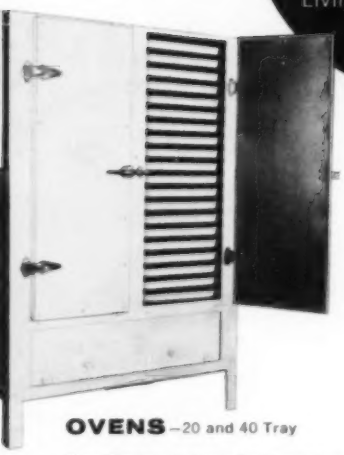
FOREMOST

MACHINE BUILDERS, INC.

83 Dorsa Avenue

Livingston, New Jersey

14



OVENS – 20 and 40 Tray

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Built tight for use with dehumidifiers

Simple!

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Air Loaders

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- Efficient

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1"	300#/hr
1½"	600#/hr
2"	1200#/hr

16

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Advanced engineering and outstanding manufacturing quality are combined in Wheelco instruments, whether the job calls for recording, controlling, or indicating. The complete Wheelco line of instruments, together with unmatched experience in every type of plastic industry installation, is your assurance of satisfaction.

Here's how Wheelco will go to work for you:

Field Engineering— A complete analysis of your needs by a broadly experienced Wheelco field engineer gets your job started right. Where required by special installation problems, additional backing is provided by specialists at Wheelco's home office.

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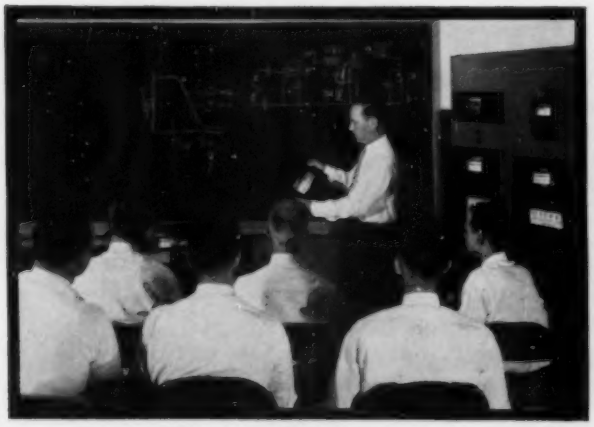

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NEW DEVELOPMENTS

Many minds at work on new ways to use plastics, new designs, and new product concepts offer ideas you can use.

Punctureproof board

By combining ¼-in. thick cork sheet with 18-gage decorative vinyl, Bond Crown & Cork Div., Continental Can Co., Chicago, Ill., has come up with a bulletin board material that appears to be unpunctured no matter how often thumbtacks, nails, hooks, etc., have been inserted and pulled out. "On-the-wall" cost of the new material, named Cork-Tex, is said to be lower than that of most present wall coverings used for similar purposes.

The bulletin board material will be produced at the Wilmington, Del. plant of BC&C, where the vinyl sheet is bonded to the cork by an adhesive operation. Vinyl sheeting for eight standard colors in a linen weave is supplied by Columbus Coated Products.

Cork-Tex will be marketed both in standard rolls, 4 by 72 ft., and in preframed boards ranging up to 12 ft. in length. Sale will be through a nationwide system of distributors.

Applications include tackboard installation in school classrooms, complete wall installation in family rooms, offices, factories, and stores.

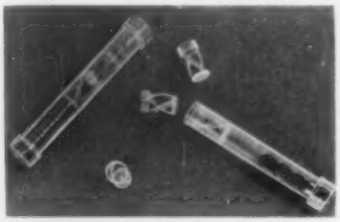
Bearings protected by PE buffers

In the shipment of tiny precision ball bearings, one manufacturer prevents damage in transit and eliminates the messy oil-bath damping technique by using polyethylene buffers to hold the items securely in vial packs. Tight packing is essential because the bearings, ranging from 1/10- to 5/8-in. O.D., are ground to tolerances of 0.00015 in., and the slightest nick or most minute contaminant could make them unserviceable for critical applications.

The bearings, made by New Hampshire Ball Bearings, Inc., Peterborough, N. H., are shipped in standard plastic vials, with remaining air space filled with either ½-in. or ¾-in. PE buffers. Several thousand of these buffers have been used in the past 10 months. In the near future, buffers measuring 13/32-, 5/8-, and 25/32-in. will be added to the sizes now in use.

The cost of the plastic buffers, from $2.35 to $3.75 per thousand, is said to be far less expensive than the cost of high-grade lubricating oil for bearing packs, and the customer does not receive bearings in an oil bath that might spill over his work area. In addition, the PE buffers are completely free from lint and dust.

The buffers are injection molded by Plastoform Kunststoff G.m.b.H., Buende, W. Germany, on 10 g. (0.35 oz.) and 40 g. (1.4 oz.) Battenfeld machines. Depending upon the buffer size, as well as the quantities involved, either 6-, 12- or 24-cavity molds are normally used. Low-density polyethylene material, Lupolen 1810H, is supplied by Badische Anilin- & Soda-Fabrik A. G., Ludwigshafen am Rhein, West Germany.



PE BUFFERS, tightly fitted into vial pack to protect ball bearings with 5/8-in. O.D. from damage, replace messier, more expensive oil-bath damper, formerly used.

PVC guides in screw machines

When the feed guide of an automatic screw machine is lined with—or made of—PVC pipe, not only is the incessant clatter of bar stock in the guide reduced to almost zero but the stock itself is protected against nicking or scratching.

This use of PVC pipe, being patented by A. M. Byers Co., Pittsburgh, Pa., is still too new to give exact service life figures. However, Byers reports that at least three companies have tested these liners for a six-month period with highly satisfactory results. They are pleased with the comparative hush that settles over the shop after the liners are installed and particularly with the reduction of damage to machinery stock.

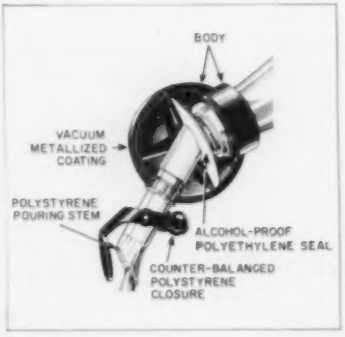
On existing machines, the PVC pipe is simply inserted in the metal guide tube and the stock run through it; on new machines, the guide itself can be made of the PVC pipe suitably supported.

Cost of guide liners installed on single spindle machines is as low as $5 each; when PVC pipe is used to replace the metal guide on new machines there is no cost increase.

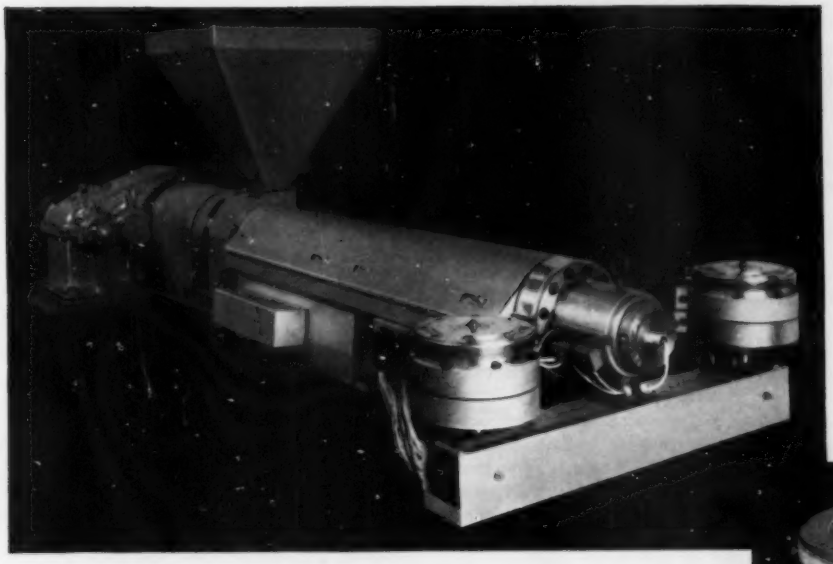
Metallized pourer

Striking a unique note in liquor merchandising campaigns, Mr. Boston Distiller Inc. recently hit the retail and bar markets with an all-plastics pouring spout that set a new high in style, appearance, utility, and promotion for its brands of liquors.

The body of the pourer (see cutaway diagram) is molded in two parts of general-purpose Dow or Monsanto polystyrene; the complete threaded section is molded integrally with one-half of the body, using an automatic unscrewing device in the mold. An insert in the body, molded of Eastman or Dow conventional polyethylene, serves as a tight, alcohol-proof seal between the glass bottle top and the pouring stem. The latter and the counterbalanced hinged closure are **(To page 164)**



BEST FOR LAYFLAT TUBING



EGAN EXTRUDERS

Available with low base for layflat tubing installations

Egan Extruders offer distinct advantages in any blown film installation! A low base permits extra cooling space, and easier access to dies and feed section. The manifold arrangement, illustrated on the above 4½" extruder, permits full output even when using small dies. The manifold is valved so that one side only can be used, if desired. Complete engineering data available upon request, covering the full line of Egan Heavy Duty Extruders.

EGAN DIES

No weld lines
More uniform gauge
Better quality film

The Standard 24" Egan Die shown above has a center feed arrangement, incorporating a specially designed mandrel. It eliminates "weld lines," and assures uniform pressure at the die orifice. The result is a more uniform gauge and better quality film!

Egan Dies are available in a wide range of sizes.

Egan

FRANK W. EGAN & COMPANY
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Manufacturers of plastics extruders, dies, take-offs, and other accessories

REPRESENTATIVES: MEXICO, D. F.-M. H. GOTTFRIED, AVENIDA 16 DE SEPTIEMBRE; JAPAN-CHUGAI BOYEKI CO., TOKYO. LICENSEE: GREAT BRITAIN-BONE BROS. LTD., WEMBLEY, MIDDLESEX.

(From page 162)

molded of high-impact Dow or Monsanto polystyrene. Two tiny molded-in bosses on the pouring stem serve as pivots for the closure, which has mating molded-in holes and is simply snapped into place.

After the polyethylene seal is inserted in one half of the body, and the pouring stem is set in position, the body is cemented in place. The entire body is then vacuum metallized with 24-carat gold.

Four sets of multi-cavity molds, produced by Special Tool & Machine Co., South Boston, Mass., were used on this job. Molding was done by Morningstar Corp., Cambridge, Mass.; metallizing was by Eyelet Specialty Co., Wallingford, Conn., and Sierad Co., Mamaroneck, N. Y.

Mr. Boston emphasizes the fact that the use of polyethylene and the threaded design of the body results in a pourer that has no corks to stick, crumble, or replace, and is superior to any pourer, regardless of price. It is sold at a premium with a bottle of liquor, with additional pourers offered at 50¢ each from the producer.

To make this pourer adaptable to and interchangeable only on Mr. Boston bottles necessitated redesign of the bottles themselves to incorporate a double thread—one for the standard closure cap and one of larger diameter for pourer. Some 2 million of the all-plastic pourers have been produced thus far.

PE breeder boxes

As its properties become more generally known, high-density polyethylene is finding markets in some unusual fields—and the volume is not always unappreciable. Among the latest such markets to develop . . . mouse breeders.

There are about 125 such breeders in the United States, each currently handling an average population of 37,000 adult mice, and many times that in young. Breeding boxes constitute an important item of expenditure for these breeders; and that's where polyethylene comes in.

Boxes owned by individual breeders range from 20 to 100,000 in number, with an average of 6060. Until recently, they had been made of wood. However, a recent government specification calls for breeding boxes that are ". . . smooth, corrosion resistant, easily cleaned, sanitized, and made of material such as plastic, stainless steel, or glass."

With the government representing the largest source of research funds for projects involving the use of mice, compliance with the new spec was generally universal.

The choice among these three materials was easy to make. Stainless steel boxes cost $24 apiece, compared to $2 for the polyethylene variety. Breakage of glass boxes made that type undesirable.

Boxes are currently produced in three sizes: 12 by 7¾ by 5⅛ in., 14 oz., 80¢ each in lots of 240 or more; 19 by 10½ by 5½ in., 1 lb., 10 oz., $1.55 each in lots of 210 or more; and 20¼ by 15½ by 5 in., 2 lb., $2.10 each in lots of 210 and over.

The boxes have rounded corners to prevent accumulation of dirt; protruding runners prevent flat surfaces from touching, avoiding sticking when boxes are nested; molded-in top permits installation on brackets when shelves are not used; molded-in bracket holders on one side of box permits insertion of record charts. In addition, they can be autoclaved.

Total resin potential is approximately 1.5 million pounds.

The boxes are molded as a proprietary item by Consolidated Molded Products Corp., Scranton, Pa., from Phillips Chemical Co.'s Marlex high-density polyethylene. Single-cavity molds, one available for each size, are run on 1- to 2-minute cycles.

Among current customers are Rockefeller Institute, Sloan-Kettering Institute, Ethicon Inc., University of Wisconsin, and numerous independent breeders across the United States. Use of such boxes for other animal breeding purposes is currently under study.

TYPICAL MOUSE FARM INSTALLATION, using polyethylene breeding boxes to comply with latest government specifications.

Mylar for capacitors

Use of Mylar polyester film in miniature capacitors has eliminated the need for outer casings and has resulted in

1) improved performance
2) much lower cost and
3) greatly decreased space requirements.

Conventional paper-dielectric capacitors require the protection of metal, ceramic, or phenolic cases against absorption of moisture. Because Mylar film has virtually zero moisture absorption, plus good electrical characteristics and mechanical strength, the new capacitors need no cases. They are produced in round or flat shapes. The manufacturer, Capcon Inc., New York, N. Y., reports a cost saving of about 90% over metal cased units and about 80% over ceramic or phenolic cased units. Space savings range up to approximately 50 percent.

Game improved

A switch from hardboard and paper to thermoformed high-impact styrene sheet has brought production, shipping, and sales advantages to the manufacturer of Blue Chip, a new stock market game.

The materials switch was made after market surveys had established encouraging acceptance of the game. Cost of the styrene sheet, extruded from Dow Styron 475, was about the same as the hardboard and paper. But, according to Technical Ventures Co., Detroit, Mich., manufacturers of Blue Chip, significant savings were realized from reduced production time—thermoforming eliminated folding and gluing operations—and distribution costs were lowered because the new games could be shipped by parcel post. The manufacturer is also convinced that the **(To page 166)**

KAUTEX
BLOW MOLDING MACHINES

No patent problems!
No continuous royalties!

U.S. PATENT STRUCTURE

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#2,898,635 **OWENS-ILLINOIS** (Burch)
#2,787,023 **KAUTEX** (Hagen)
435,547 **KAUTEX** (Hagen)
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"SAVE HARMLESS" GUARANTEE

FULLY AUTOMATIC
complete with synchronized extruder

$15,000.00 (F.O.B. Germany)

- Price includes a fully paid, protected license under the above patents. No other machine seller can offer the same trouble-free patent structure.
- Kautex is the world's largest seller of blow molding equipment.
- 6 sizes (1/30 ounce to 50 gallons) with and without extruders.
- Up to 50 dry cycles per minute. (The fastest machine in the world).
- Single and double extrusions and low mold costs.

SOME SALES AREAS AVAILABLE

KAUTEX-U. S. SALES CO. INC. FLUSHING 54, N.Y.C. LEnox 9-3000

Taylor-Emmett Timer insures

REPEATABILITY OF CYCLES

Type D765 ROBOTRON* Timer—the complete timing control for plastic molding presses. Panel is so simple that any possible cycle sequence can be set up in as short a time as 10 seconds, without particular skill or familiarity.

CHECK THESE FEATURES:

Completely Packaged Unit • Airtight Enclosure • Rapid Setup • Cycles Quickly Changed • Extended Rangeability • Enclosed Electrical Component • Plug-in Elements • Etched Circuits

Taylor-Emmett **NEV-R-GRIND*** *Valves mean* **NO WARPING... NO FOULING**

Three-Way (E380) and Two-Way (E370) Valves are fully balanced, cylinder operated, compact and have excellent capacity. Available in 3500 and 6000 psi. body ratings. Both are normally operated at 35 to 50 psi. air pressure.
Fully balanced design permits application of pressure to any port connection. Type E370 is available either normally open, or normally closed. Sizes 1" to 4".

Type D3532 Cylinder-Operated Valve is half the size of conventional valves, has one quarter the parts. Extremely compact and maintenance-free. 750 psi. Sizes ½" to 2½". Normally open: normally closed: 3-way semi-balanced.

Call your Taylor Field Engineer, or write Taylor-Emmett Controls, Inc., Akron, Ohio, or Taylor Instrument Companies, Rochester, New York.

*Trade-Mark

Taylor-Emmett Controls, Inc.
A SUBSIDIARY OF Taylor Instrument Companies

thermoformed styrene sheet parts, produced by The Lus-Trus Corp., Ypsilanti, Mich., give the product a more "expensive" look and, hence, greater sales possibilities.

. . . And in brief

• Diaper pail is molded of Monsanto low-density PE by Federal Tool Corp., Chicago, Ill. Melt index is 8. The pail and cover are each molded in single-cavity molds; a two-cavity mold is used for grip on wire bail. Capacity is 4 gallons.

• Molded butyrate boat letters, 3 in. high and predrilled, are said to meet new Federal boating law (Public Law 85-911. Molded by Jamison Plastic Corp., N. Bellmore, N. Y., for Allan Marine Inc., Hicksville, N. Y., of Eastman Chemical's Tenite material. Cost is 15¢ per letter.

• Temporary shelter to house production facilities after a fire destroyed the plant of The Ley Mfg. Co., Akron, Ohio, consists of PE airhouse. Film used was 8 mil, reinforced by heat seal and PE tape. Building was 25 ft. high, 40-ft. wide, 75 ft. long, provided 3000 sq. ft. of unobstructed work area. Cost was approximately $400, not including fans and accessory equipment. Building was designed and fabricated by Canton Containers Inc., Canton, Ohio.

• Another air-supported structure, this one of Union Carbide Plastic's Krene vinyl sheeting, for making outdoor pools available for year-round use, is produced by Plastimayd Corp., Portland, Ore.

• Throttlable Penton valves have been added by Vanton Pump & Equipment Corp., Hillside, N. J., to its product line for application requiring good chemical resistance to organic and inorganic agents at elevated temperatures. Penton chlorinated polyether is a product of Hercules Powder Co.—End

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LITERATURE

Write for these publications to the companies listed. Unless otherwise specified, they will be sent gratis to executives who request them on business stationery.

Plastic and Chemical Materials. Catalog gives special properties, product features, and other technical data for a line of polycarbonate resins (Lexan), phenolic molding powders, phenolic laminating varnishes, phenolic foundry resins, coating resins (Methylon), phenolic industrial resins and varnishes, and electrically-fused magnesium oxide. Booklet CDC-370. 12 pages. *General Electric Co., 1 Plastics Ave., Pittsfield, Mass.*

Hydroxyethyl cellulose. Properties, preparation of solutions, film and coating properties, applications, toxicological properties, specification limits, etc., for Cellosize hydroxyethyl cellulose, a nonionic synthetic colloid used as a thickener, binder, stabilizer, protective colloid, film-former, and coating. 16 pages. *Union Carbide Chemicals Co., 30 E. 42nd St., New York 17, N. Y.*

Clamps. Features, uses, etc., for a line of mechanical and air-operated clamps for holding masks and parts, and standard and special fixtures used to speed up production in color decoration of mass produced parts. 2 pages. *Conforming Matrix Corp., 364 Toledo Factories Bldg., Toledo 2, Ohio.*

Teflon. Properties and applications for Teflon coating of metal and ceramic tools and parts to contribute anti-sticking or chemically resistant properties. 4 pages. *Cadillac Plastic & Chemical Co., 15111 Second Ave., Detroit 3, Mich.*

Compression testers. Sizes, specifications, uses, etc., for a line of compression testers, which can perform over 15 different tests. Includes illustrations of squeeze, squash, bend, yank, and jab applications. 6 pages. *Testing Machines Inc., 72 Jericho Turnpike, Mineola, N. Y.*

Baling presses. Specifications, features, uses, etc., for a line of hydraulic baling presses, which are used by plastics firms for baling of scrap. 12 pages. *Consolidated Baling Machine Co., 400-408 Third Ave., Brooklyn 15, N. Y.*

Plastics boxes. Sizes, shapes, etc., for a line of plastics boxes, balls, bags, drawers, etc. 8 pages. *Harkin Affiliates Inc., 95 Madison Ave., New York 16, N. Y.*

Man-Made Textile Encyclopedia. This reference book runs the gamut from polymer science to laundering; from fiber production to fabric and clothing manufacture. Chapters include raw materials; fiber manufacturing processes; fiber characteristics; fiber identification; woven and industrial textiles; dyeing and printing; marketing; etc. Includes U. S. and world statistics, fiber trademarks, and glossary. 914 pages. Price: $27.50. *Textile Book Publishers Inc., 250 Fifth Ave., New York 1, N. Y.*

Primer on the Labor Management Reporting and Disclosure Act of 1959. A question and answer discussion designed to acquaint the plastics industry with the probable effects of the new labor law. 16 pages. *The Society of the Plastics Industry Inc., 250 Park Ave., New York 17, N. Y.*

Polymeric plasticizer. Properties, performance data, etc., for Polymeric Plasticizer NP-10, an alcohol terminated polyester of neopentyl glycol and adipic acid. Bulletin L-103. 8 pages. *Eastman Chemical Products Inc., Kingsport, Tenn.*

Machining Thermoplastics. Outlines recommended procedures for machining and finishing thermoplastic sheets, rods, and tubes — sawing, routing, drilling, turning, shearing, punching, grinding, and finishing. 8 pages. *Cadillac Plastic and Chemical Co., 15111 Second Avenue, Detroit 3, Mich.*

Plastic hammers. Sizes, weights, uses, etc., for a line of plastic hammers, available with or without replaceable screw-on plastic tips. Similar data on "no-bounce" and babbitt hammers and tamper drifts. 4 pages. *Metocraft Alloy & Plastic Co., 1039 Memorial Ave., W. Springfield, Mass.*

PVC tubes and fittings. Mechanical, thermal, and electrical properties; corrosion and chemical resistance; temperature limitation; working pressures and stresses; frictional losses; etc., for a line of high-impact, rigid polyvinyl chloride tubes and fittings. 14 pages. *Yorkshire Imperial Metals Ltd., P. O. Box 166, Leeds, England.* U. S. Agent: *C. Tennant, Sons & Co., of New York, 100 Park Ave., New York 17, N. Y.*

Plasticizers. Physical and chemical properties, specification data, etc., for a line of plasticizers. Catalog L-104. 34 pages. *Eastman Chemical Products Inc., Kingsport, Tenn.*

Asbestos-cement base sheet. Physical characteristics, uses, features, etc., for using Micro-Flexboard, an asbestos-cement base sheet, as a substrate for laminating to reinforced plastics, vinyl film, vinyl fabrics, etc. Bulletin MF 1-A. 6 pages. *Johns-Manville, 22 E. 40th St., New York 16, N. Y.*

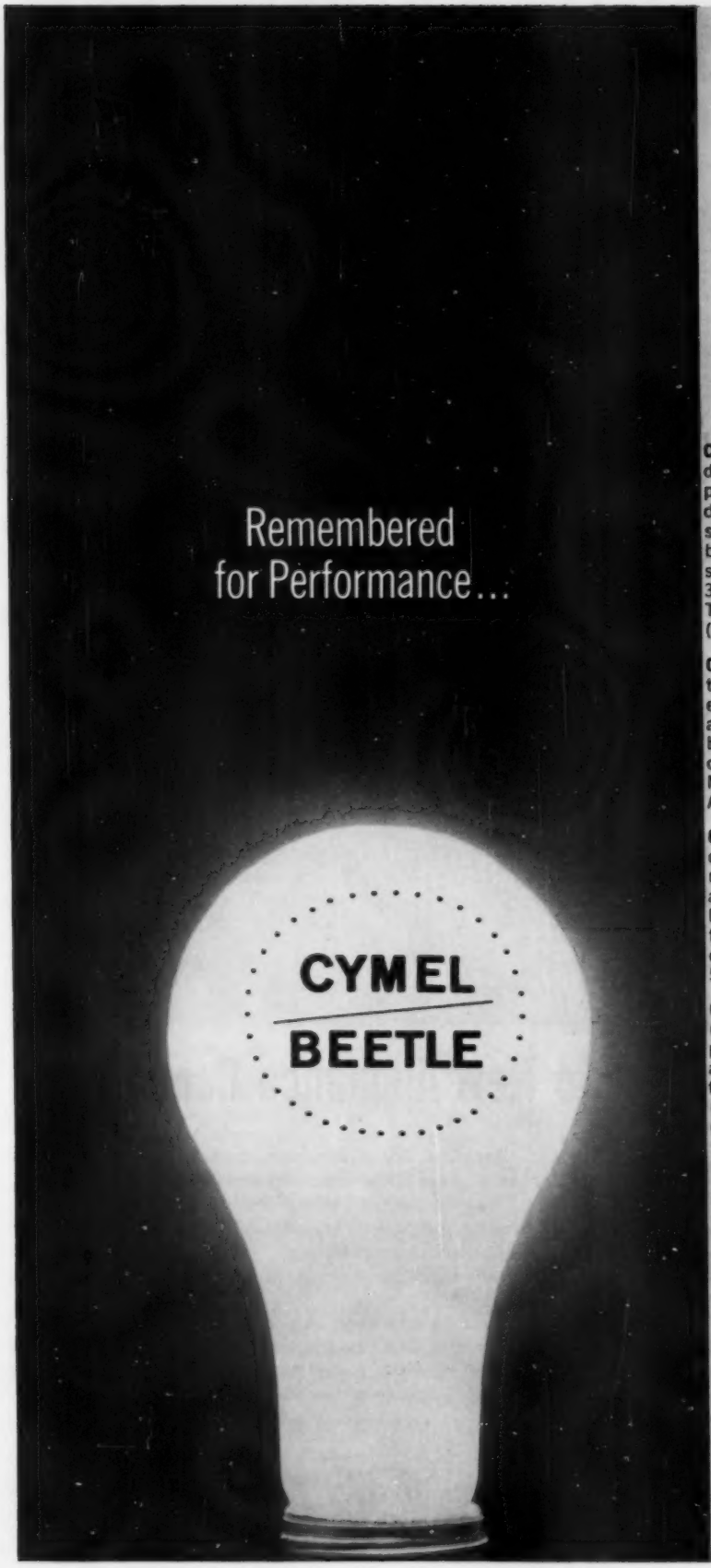
Resorcinol-based resin. Physical and chemical properties, compatability with other resins, applications, toxicity, etc., for Kopoxite 159 resorcinol diglycidyl ether (RDGE). Bulletin K-2967. 20 pages. *Chemicals & Dyestuffs Div., Development Dept., Koppers Co. Inc., Pittsburgh 19, Pa.*

Industrial chemicals. Physical properties, applications, and shipping data for 400 synthetic organic chemicals used in the plastics and other industries. 28 pages. *Union Carbide Chemicals Co., 30 E. 42nd St., New York 17, N. Y.*

Fire-resistant polyurethane foam. Properties, stability, formulation and preparation of foam, cure, etc., for Hetrofoam 16-17, a new alkyd resin system developed for the preparation of rigid fire-resistant polyurethane foam with low K factor. Bulletin 14. 5 pages. *Hooker Chemical Corp., P. O. Box 344, Niagara Falls, N. Y.*

Molecular sieves. "Chemical Loaded Molecular Sieves in Rubber and Plastics" discusses general properties of the product, with emphasis on its uses in latent curing and such factors as release temperatures vs. volatility. 12 pages. *Linde Co., 30 E. 42nd St., New York 17, N. Y.*

Locating Leaks in Vacuum Systems. Shows how to use **(To page 171)**



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HIGH ARC RESISTANCE
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EXCELLENT ABRASION-RESISTANCE
CHEMICAL RESISTANCE

CYMEL 3135–3136 (glass-filled) Additional distinctive properties: outstanding electrical properties; high impact resistance; extraordinary flame resistance; good dimensional stability. Typical applications: circuit breaker boxes; terminal strips; connectors; coil forms; stand-off insulators. Specifications: Cymel 3135 (MMI-30, MIL-M-14E, Federal L-M-181 Type 8; ASTM D704-55T Type 8); Cymel 3136 (MIL-M-19061, MMI-5).

CYMEL 592 (asbestos-filled) Additional distinctive properties: resistance to atmospheric extremes; high dielectric strength. Typical applications: connector plugs; terminal blocks; a/c, automotive and heavy duty industrial ignition parts. Specifications: MIL-M-14E MME; Federal L-M-181 Type 2; ASTM D704-55T Type 2, SP1 SPEC NO. 27025.

CYMEL 1077 (alpha cellulose-filled) Additional distinctive properties: Surface hardness, heat resistance, unlimited color range. Typical applications: appliance housings, shaver housings, business machine keys. Specifications: MIL-M-14E – Type CMG (in approved colors); Federal L-M-181 Type 1; ASTM D704-55T Type 1, SP1 SPEC NO. 30026.

CYMEL 1500 (wood flour-filled)–CYMEL 1502 (alpha cellulose-filled) Additional distinctive properties: Good insert retention. Typical applications: meter blocks, ignition parts, terminal strips. Specifications: Cymel 1500 (MIL-M-14E Type CMG, Federal L-M-181 Type 6, ASTM D704-55T Type 6); Cymel 1502 (MIL-M-14E Type CMG, Federal L-M-181 Type 7; ASTM D704-55T Type 7.

BEETLE® UREA (alpha-filled) Additional distinctive properties: Economy of fabrication, economy of material, myriad translucent and opaque colors. Typical applications: wiring devices, home circuit breakers, tube bases, appliance housings. Specifications: Federal L-P-406A, LC 726-1, ASTM D705-55, Grade 1 (Arc resistance limits are in process of revision by ASTM), SP1 SPEC NO. 27026.

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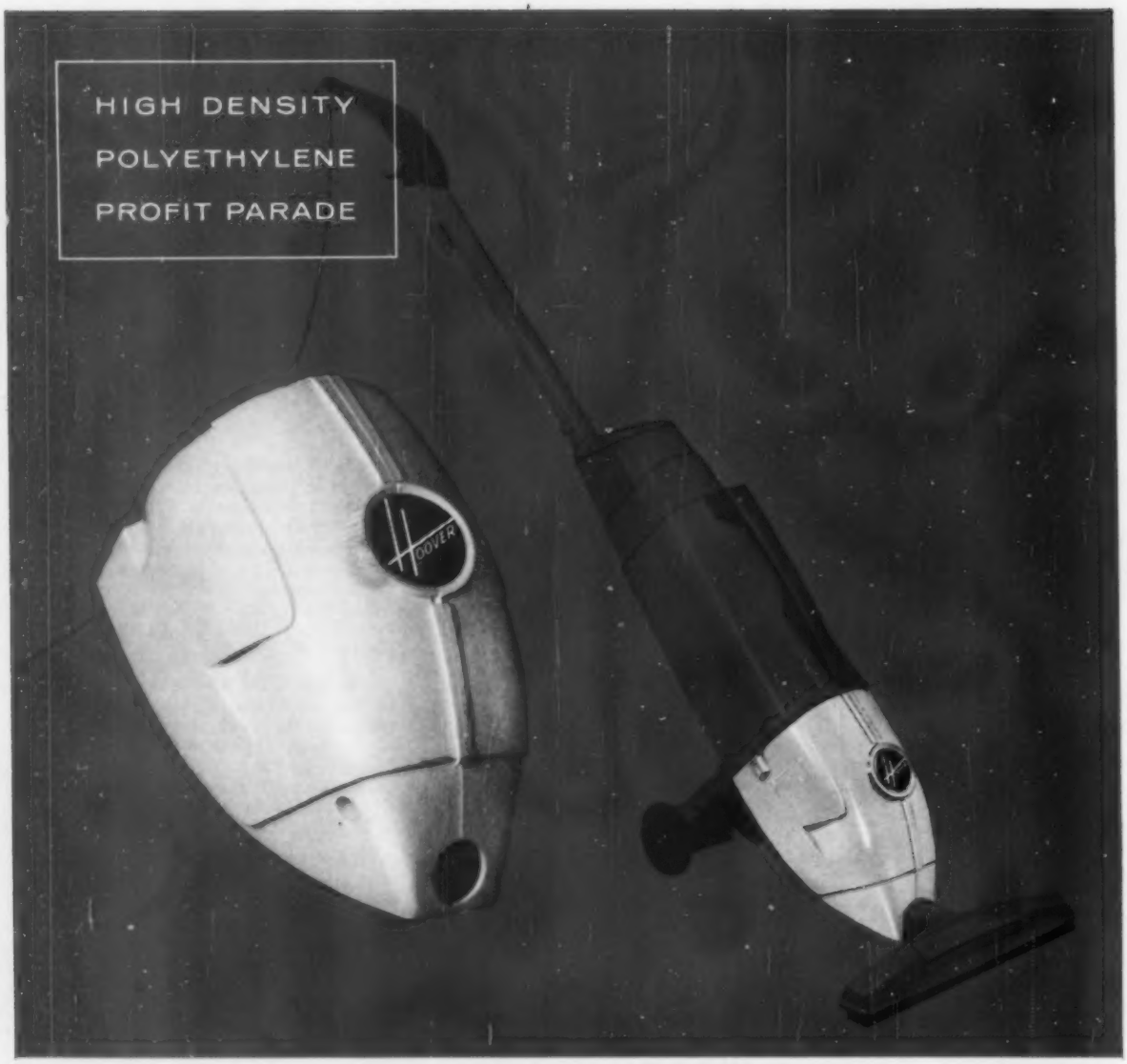
of sheet plastic forming machines. 2 pages. *Taber Instrument Corp., 111*



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Are you working on a "new concept" product? High density polyethylene from Grace could provide a better answer to your product's unique requirements than any other raw material. The Hoover Company reached just such a conclusion in screening plastics for the motor housing of their new home appliance concept—an electric floor washer that cleans with its own detergent solution and dries by vacuum action.

Why did Hoover select Grex high density polyethylene? The motor housing has to be unaffected by moisture and the chemicals with which it comes in contact. It must withstand heat generated by the motor and possess high impact strength. Its color—a primrose yellow—has to be an exact match of the other parts. Just as important, the housing must be light in weight, economical to produce and flame retardant.

By specifying Grex, Hoover obtained the motor housing they needed. Although the requirements for your new product may not be the same as Hoover's, bear in mind that this Grace plastic offers many remarkable properties still waiting to be exploited.

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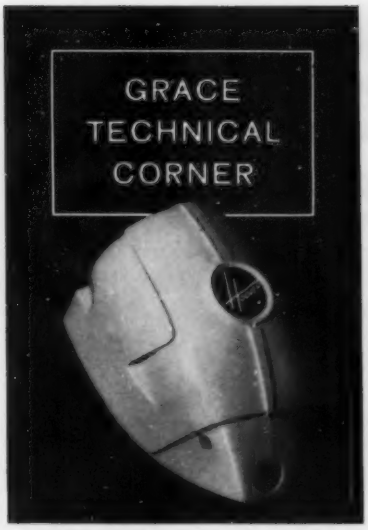

Hoover motor housing is one of many applications for Grex flame retardants.

Grex flame retardant at left is self-extinguishing.

Some of the most interesting problems encountered in molding the motor housing shown above are related to the use of Grex flame retardant compounds. If you have an application for this material, count on Grace for the same kind of technical assistance provided here.

Resin selection. Grace offers five different flame retardant grades. As a general rule, a grade with good flow characteristics is recommended for all but the smallest parts, bearing in mind that molding temperatures should not exceed 400° F. This project required use of the freest flowing since a relatively large shot is needed to fill the 2-cavity mold, and must flow in with minimum distortion.

Mold design. One of the objects in designing molds for high density polyethylene flame retardants is to obtain a short flow into the cavity with little change of direction. The motor housing mold was made to operate with greater efficiency by shortening its runner system and opening up its gates. Differential shrinkage and part distortion were avoided by redesigning the cavities to eliminate heavy sections and obtain maximum uniformity in wall thickness.

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halogen-sensitive vacuum leak detectors in the laboratory and in production to locate leaks down to 1×10^{-9} cc./sec. Bulletin GET-2935. 3 pages. *General Electric Co., Schenectady 5, N. Y.*

PE film for ice skating rinks. Describes how to construct an ice skating rink with Ger-Pak polyethylene film. Bulletin GP-36. 2 pages. *Gering Products Inc., Kenilworth, N. J.*

Pigments. "Colors for Every Purpose" describes a line of pigments and dyes available for the plastics and other industries. Catalog R. 6 pages. *Pylam Products Co., 799 Greenwich St., New York 14, N. Y.*

Plastic receptacles. Illustrates a line of cellulose plastic receptacles for handling store merchandise, supplies, and waste materials. 4 pages. *National Vulcanized Fibre Co., 1059 Beech St., Wilmington 99, Del.*

Nylon. Physical properties; available sizes; chemical resistance; moisture absorption; data on moisture conditioning, machining, bonding, welding, and coloring of nylon parts. 8 pages. *Cadillac Plastic and Chemical Co., 15111 Second Avenue, Detroit 3, Mich.*

Facts on Phenolics. Booklet, which includes data on phenolics and diallyl phthalates, gives physical properties of Durez molding compounds by classified groups. 16 pages. *Durez Plastics Div., Hooker Chemical Corp., N. Tonawanda, N. Y.*

Electric motor controls. Design data, stocking information, uses, etc., for a line of manual starters, magnetic controls, drum controllers, pressure switches, pilot devices, etc. Catalog 5900. 72 pages. *Furnas Electric Co., 1182 McKee St., Batavia, Ill.*

Plastic pipe. Sizes, specifications, uses, etc., of flexible polyethylene pipe. Includes chemical resistance chart. 4 pages. *H. K. Porter Co. Inc., Quaker Rubber Div., Philadelphia 24, Pa.*

Extrusion of Film for Packaging summarizes the commercial techniques for extruding PE into film for packaging. Includes a chart that shows how film extruded from Tenite polyethylene is classified according to the U. S. Dept. of Commerce standards. TIB No. 2. 12 pages. *Eastman Chemical Products Inc., Kingsport, Tenn.*

Forming and fabricating machines. Specifications, uses, etc., for a line of sheet plastic forming machines. 2 pages. *Taber Instrument Corp., 111 Goundry St., N. Tonawanda, N. Y.*

Production facilities. Folder describes facilities available for the precision machining of plastics sheets, rods, and tubes for automotive, electronic, aeronautic, electrical, and industrial equipment and appliances. 4 pages. *Insulating Fabricators Inc., 154 Union Ave., East Rutherford, N. J.*

Anti-static compounds. Describes uses for Anti-Static #79 and 79-OL, which destaticize and prevent static-caused dust and dirt attraction on plastics, among other uses. Bulletin 5. 4 pages. *Merix Chemical Co., 2234 E. 75th St., Chicago 49, Ill.*

Calculator. Simplified calculator for determining most economical production runs for lowest total part cost available at 50¢ each. *Grayhill Moldtronics Inc., 561 Hillgrove Ave., La Grange, Ill.*

Dialdehyde starch. Historical development, product description, chemical properties, uses, toxicity, bibliography, etc., for Sumstar dialdehyde starch, which is used as an insolubilizing agent, protective coating, thickening agent, and similar uses. Bulletin 6-129. 40 pages. *Miles Chemical Co., Elkhart, Ind.*

Rigid vinyl sheet. Properties, grades, applications, printing and marking data, fabricating notes, etc., for Cobex rigid vinyl sheet. Bulletin 5910. 14 pages. *BX Plastics Ltd., Higham Station Ave., London E4, England.*

Adhesives. "Science Makes Possible New Adhesives" describes a line of adhesives available for the plastics and other industries. 12 pages. *Adhesive Products Corp., 1660 Boone Ave., New York 60, N. Y.*

Thermoforming techniques. Designed to improve knowledge of the machinery function, material characteristics and performance required of vacuum forming machines. Various methods of vacuum forming—cavity, drape, plug assist, inverted drape, vacuum-snap-back, billow, blow-up vacuum reverse, and other processes—are outlined. 22 pages. *Comet Industries, 9865 Franklin Ave., Franklin Park, Ill.*

Floor coating systems. Coating chart compares protective coating systems for concrete floors, including resistance of each system to chemicals, thermal shock, abra- **(To page 173)**

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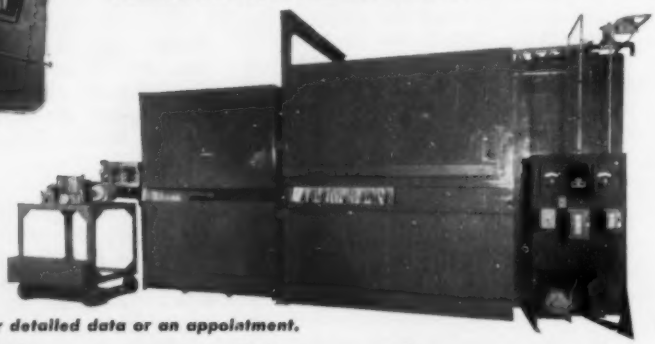

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sion, and temperature. Chart 10. 4 pages. *Carboline Co., 32 Hanley Industrial Court, St. Louis 17, Mo.*

Copper clad laminate. Electrical, physical, and chemical properties, uses, etc., for Rexolite 2200, a reinforced thermosetting, styrene-base copolymer insulating material for use at ultra high and microwave frequencies in both wet and dry locations. 2 pages. *The Rex Corp., West Acton, Mass.*

Specialty chemicals. "Morningstar-Paisley Has Already Touched Your Life Several Times Today" shows how the company's line of starches, dextrines, processed gums, adhesives, and specialty chemicals is used in many industries, including the making of polyvinyl acetate emulsions, PVC plastisols, etc. 8 pages. *Morningstar-Paisley Inc., 630 W. 51st St., New York 19, N. Y.*

Polyvinyl fluoride film. Applications, physical properties, weatherability, chemical resistance, electrical properties, surfacing performances, heat sealability, handling practices, sample, etc. for Teslar polyvinyl fluoride film. 22 pages. *Film Dept., E. I. du Pont de Nemours & Co. Inc., Wilmington 98, Del.*

Industrial Plastics. Outlines products and services of the company, including properties, applications, etc., of Polypenco nylon, Teflon, Fluorosint TFE-base resin, and other industrial plastics. 16 pages. *The Polymer Corp., Reading, Pa.*

Scientific Information Activities of Federal Agencies. Bulletin is one of series published by National Science Foundation describing activities of various government agencies. This one describes U. S. Patent Office. Report NSF 59-58. 6 pages. Price: 15 cents; 25% discount on orders of 100 copies or more. Available from nearest Department of Commerce field office or *Supt. of Documents, U. S. Government Printing Office, Washington 25, D. C.*

Control panels. Types available, uses, etc., for a line of automatic control panels, which are used for handling of plastic cube pellets and similar materials. Bulletin G-9. 12 pages. *Fuller Co., Catasauqua, Pa.*

Tableting equipment. Describes a line of machines for tableting plastics and other materials; drying ovens; coating stands; mixers; granulators; tablet dusters; etc. 8 pages. *Arthur Colton Co., 3400 E. Lafayette Ave., Detroit 7, Mich.*—**End**

A New Twist in Plastics

MOBILE HOME OWNERS NEEDED a better flexible tube for sewer connection, according to a special sales study by the Gemmer Manufacturing Co. of Detroit. Requirements demanded that the tubing be resistant to all types of sewage, weather and household detergents, strong and easily connected. It would have to be made of a rather rigid, inexpensive material with good forming characteristics, capable of being welded as it was formed. To meet these requirements, a new type of tubing material was required.

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Plastics Digest

(*From pp. 54, 56*)

in permeability and diffusion coefficients cannot be explained on the basis of reasonable variations in the amount of crystallinity between otherwise comparable polymers or by reasonable variations in the way in which the crystalline regions occur in the amorphous matrix. Variations in the structure of the amorphous phase from specimen to specimen are responsible for irreproducible properties.

Fundamental properties of plastics. T. D. Callinan and A. E. Javitz. Electrical Mfg. *64*, 105-20 (Aug. 1959). Some of the fundamental properties of polymer systems are described and related to the engineering properties of plastics. Included are synthesis, production processes, and the structure of addition and condensation polymers. The theoretical basis for the mechanical properties of polymers is developed. The electrical and chemical properties are also treated.

Testing

Melt viscosity of polyethylene. Shear dependence of viscosity. L. Marker, R. Early, and S. L. Aggarwal. J. Polymer Sci. *38*, 381-92 (Aug. 1959). The melt index apparatus was adapted for use as a simple rheometer. Changes in orifice diameter from 0.0425 to 0.2000 in. and in weight applied to the piston from 250 to 3250 g. permit an effective range of shear stress from 10^4 to 10^6 dynes/cm^2. With this apparatus, the fluidity of polyethylene as a function of shear stress is shown to be a linear function of the shear stress in the range studied. Consistent data using different orifices were obtained by correcting for the friction between piston and barrel. Two parameters, the fluidity at zero shear rate and the shear-stress dependency of fluidity, are sufficient for the characterization of the flow behavior of polyethylenes. To account for the effect of temperature on the shear dependence of viscous flow, as determined from measurements at several temperatures, two activation energies are needed, one corresponding to each of the two parameters that is mentioned.

Testing of impact strength in plastic moldings. W. Woebcken. Kunststoffe *49*, 485-88 (Sept. 1959). The impact strength test on plastic moldings is of great interest because this property depends not only upon the type of material used and the design of the molding, but also on the processing technique employed. In electrical engineering compliance to certain VDE rules and standards of various types has been required. Based on this experience, a test method for plastic moldings is suggested which permits strength to be measured at any point on the molding.

Chemistry

s-Triazine as a new co-reactant in polymer synthesis. C. Grundmann and A. Kreutzberger. J. Polymer Sci. *38*, 425-32 (Aug. 1959). Trimeric hydrogen cyanide, the structure of which has recently been established as s-triazine, is an important source for methine (=CH—) groups by means of which other functional groups can be linked with each other. Advantage has been taken of the methinylation capability of s-triazine to link the functional groups in diamines. While the lower members of the aliphatic diamine series, i.e., ethylenediamine and 1,3-propanediamine, react with s-triazine to give cyclic compounds, higher diamine homologs like 1,5-pentanediamine and 1,6-hexanediamine furnish exclusively open chain polymers termed polyamidines. In view of the fact that other functional groups, e.g., SH, $NHNH_2$, and OH, are amenable to this reaction also, s-triazine may be considered as a novel important starting material for new types of chain-like polymers containing hetero atoms.

Publishers' addresses

Adhesives Age: Palmerton Publishing Co. Inc., 101 W. 31st St., New York 1, N. Y.

British Plastics: Iliffe & Sons Ltd., Dorset House, Stamford St., London SE1, England

Chemical Week: McGraw-Hill Publishing Co. Inc., 330 W. 42nd St., New York 36, N. Y.

Electrical Manufacturing: The Gage Publishing Co., 1250 Sixth Ave., New York 20, N. Y.

Industrial and Engineering Chemistry: American Chemical Society, 1155 Sixteenth St., N. W., Washington 6, D. C.

Journal of the American Chemical Society: American Chemical Society, 1155 Sixteenth St., N. W., Washington 6, D. C.

Journal of Polymer Science: Interscience Publishers Inc., 250 Fifth Ave., New York 1, N. Y.

Kolloid Zeitschrift: Verlag Dr. Dietrich Steinkopff, Holzhofallee 35, Darmstadt, Germany.

Kunststoffe: Karl Hanser Verlag, Leonard-Eck Strasse 7, Munich 27, Germany.

Modern Packaging: Modern Packaging Corp., 575 Madison Ave., New York 22, N. Y.

Plastics (London): Temple Press Ltd., Bowling Greene Lane, London EC1, England.

Plastics Technology: Bill Brothers Publishing Corp., 630 Third Ave., New York 17, N. Y.

Space Aeronautics: Conover-Mast Publications Inc., 205 E. 42nd St., New York 17, N. Y.

SPE Journal: Society of Plastics Engineers Inc., 65 Prospect St., Stamford, Conn.—**End**

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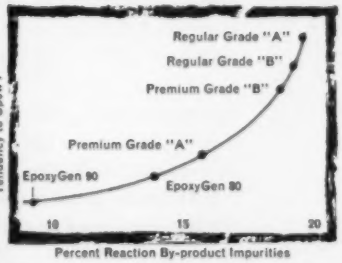

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Polypropylene

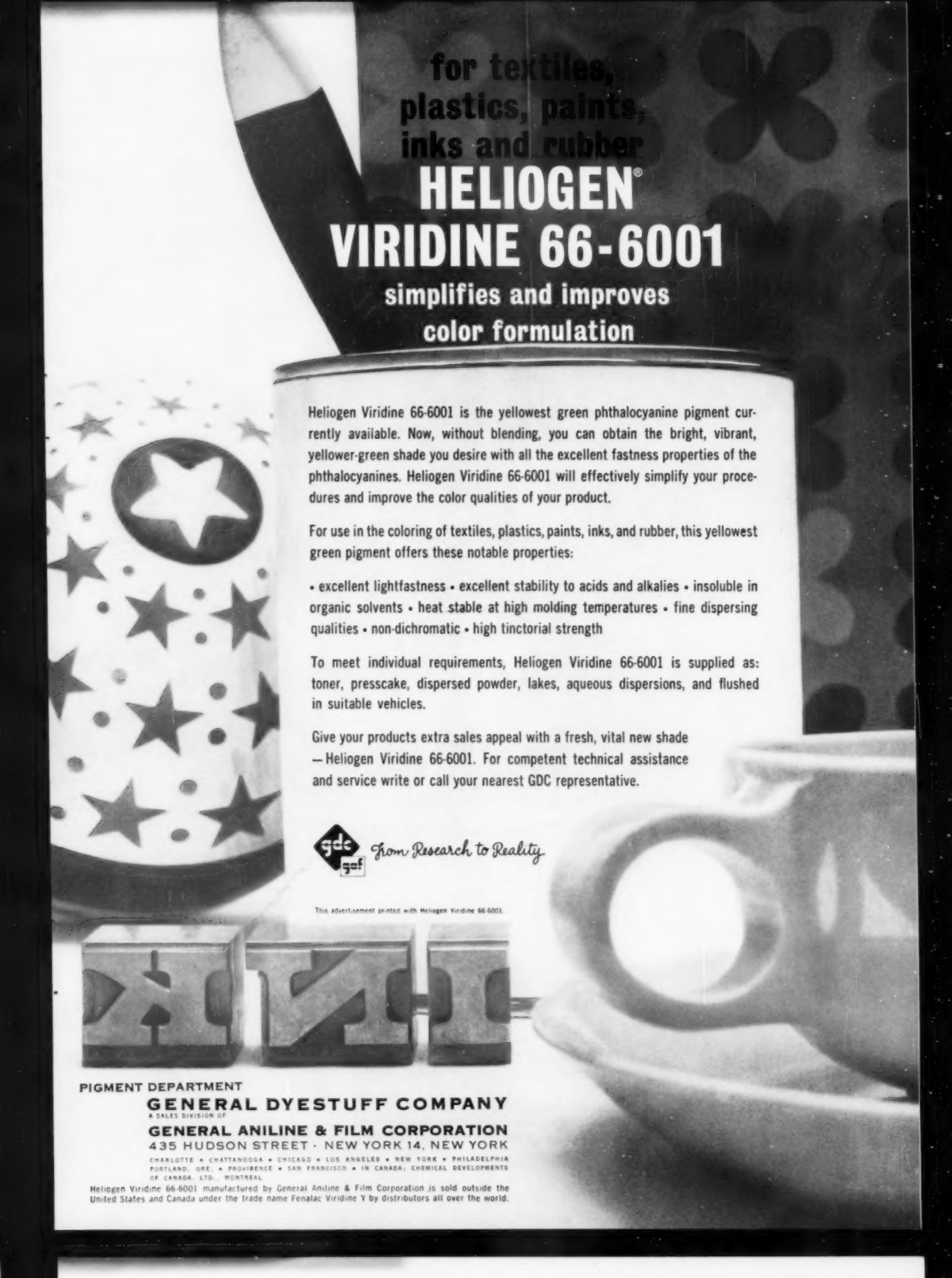
(From pp. 81-85)

On the average, polypropylene compounds with a 1 or 2 melt index will process in a manner similar to conventional PE with an 8 to 10 melt index. Where respondents did mention molding difficulties, polypropylene was generally being adapted to a job that *had been engineered for another type of plastic*. Most suppliers feel that this is the crux of the problem. In the words of one, ". . . the special properties of polypropylene call for a completely new frame of reference in product design and production, as well as in processing."

Shrinkage differentials must be taken into account (polypropylene's mold shrinkage is 0.010 to 0.025 in./in.), proper gating seems to be an important key to successful molding, mold temperature control is necessary, and so on—but enough engineering data on all these points are currently available from materials suppliers to enable any processor to handle polypropylene successfully.

Many of the other problems mentioned by respondents can be traced to the newness of the material and lack of familiarity with it. Take the oft-discussed subject of polypropylene's low temperature brittleness as another example. While it would certainly be foolish to mold an item of polypropylene that might be required to take very rapidly applied loads at low temperatures, end-users have also found that if they determine the low temperature requirements for any proposed application under actual use conditions, generally circumstances can be avoided and steps taken to bypass trouble spots.

Product design, wall thickness, and molding conditions can all be modified to permit a molded polypropylene product to perform quite satisfactorily in actual low-temperature use conditions. A telephone carrying case molded for the Signal Corps with thick walls and no stress strains, for example, was shown to successfully withstand a 4- to 5-ft. drop at −100° F.—and polypropylene automobile steering wheels and armrests have been impact tested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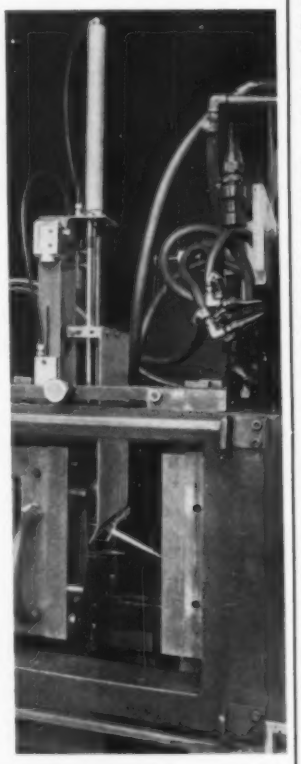

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at −30° F. and cycled through extreme temperature changes with complete satisfaction. It is also possible that some of the new polypropylene copolymers, alloys, and blends which suppliers are now working on may at last be the answer to the low-temperature problem.

The rapid oxidation of unstabilized polypropylene on exposure to heat or ultra-violet light—another of the handicaps reported for polypropylene—has been brought under control with the development of improved new stabilizer systems. Stabilized polypropylene monofilaments that can retain their serviceable strength and color after 1000 hr. exposure to sun lamps (which amounts to about 2 summers of normal outdoor exposure) have been reported.

Potential applications

Over-all, the reaction to polypropylene has been a good one. The material has much to recommend it as the applications shown on pp. 81-85 indicate. Some of the newer products are just now starting to take off. Polypropylene cabinet parts for TV are already in the works by two manufacturers (one placed his model on the market a few months ago, the other is expected to be out with his by mid-year).

And from Europe come application reports of polypropylene parts for air conditioners, electric heaters, and medical sterilizers (these will be covered in an article in next month's issue of MODERN PLASTICS).

Taking all these applications into consideration, potential users of polypropylene should have sufficient background on which to base decisions. Past experience with polyethylene markets should also help in building up market potential for polypropylene. If the material is used only where its proper ties and sound engineering principles dictate its use, there is no reason why polypropylene shouldn't become a "1 billion-pound-a-year" plastic by the end of the 1960's.

Special thanks to Hercules Powder Co. Inc. and Spencer Chemical Co. for permission to use excerpts from company literature on polypropylene markets. Thanks also to AviSun Corp., Catalin Corp. of America, Eastman Chemical Products, Enjay, Co. Inc., and Montecatini Soc. Gen.—End

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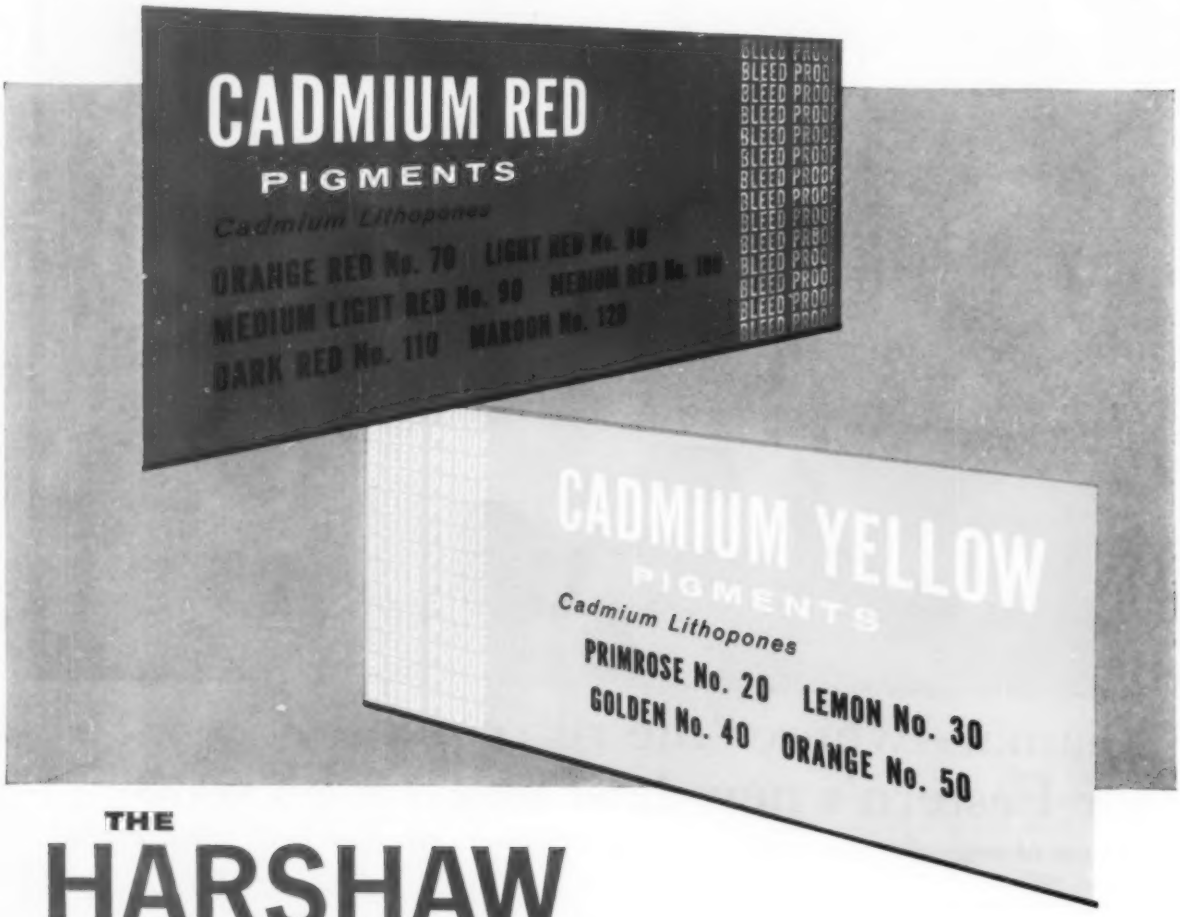

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Large-size objects

(*From pp. 86-87*)

Production of an item by the Engel process involves several elements: mold, resin, oven, cooling device, and conveyors.

How it works

Molds are constructed from light-gage steel, using sheet metal fabrication techniques. A simple mold for an open top drum, for example, consists of a body section, an open liner that fits inside the top of the body section, and a cover (see photo on p. 87).

The first step in the process is to fill the mold (with liner in place) with finely ground resin (about the consistency of table salt). The mold, which is coated with a release agent, is filled all the way to the top and closed.

Next the mold is placed in an oven whose temperature is closely regulated. While in the oven, the peripheral resin fuses, leaving a layer of plastic on the mold wall. The liner prevents fusion of the powder in the areas it covers and also serves to shape the top edge of the piece produced.

At the end of the fusing period, the mold is removed from the oven and the unfused powder dumped for re-use, the fused layer remaining on the mold wall. The mold is then returned to the oven to smooth the inside of the layer. Next, it is cooled by water immersion or spray and the finished part stripped from it for trimming to finish size.

Wall thickness is determined by the length of the fusion period and oven temperature. Part stiffness is presently obtained by controlling the wall thickness of the entire piece rather than by molded-in rib sections often found in injection molded parts. (Incidentally, the Engel process is not expected to compete with injection molding for the majority of applications involving small parts and long runs.) Since no material flow is involved, items produced by the Engel process are essentially stress free, minimizing warpage and stress cracking.

Spencer reports that the nature of the fusion process affords opportunities for incorporating different materials in the same mold. For example, a milk can produced in Europe has an outer layer of aluminum-pigmented polyethylene fused to an inner layer of unpigmented polyethylene. It has been demonstrated experimentally that different materials such as nylon and PE can also be used in this manner.

Volume and markets

Estimates place polyethylene resin consumption potential for Engel-process-produced items within the next five years at more than 6 million lb., divided largely into four market areas: shipping containers; tote and delivery boxes; carts and tanks; and consumer products.

Shipping containers: The best prospects are in 13-gal. multi-trip carboys and semi-rigid liners for 30- and 55-gal. tanks.

Tote boxes: Engel-produced items are expected to compete with galvanized and stainless steel, aluminum, vulcanized fibre,

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RP, and rubber-modified styrenes. Using the process, PE boxes can be produced economically in low volumes.

Carts and portable tanks: This category includes containers used in the laundry industries, meat packing (brine tanks for storage and transportation of cured meats), commercial-sized waste containers, and brine tanks for water softeners. An indication of the economies of the process can be gleaned from the fact that an Engel-produced meat tank with 3/8- to 1/4-in. wall, including stainless steel supporting frame, is estimated to cost about $100 less than a similar stainless steel tank.

General-purpose tanks—750 gal. and smaller: Price estimates indicate that such tanks produced by the Engel process would be about $4 per sq. ft. cheaper than stainless steel and competitive with other types (mild steel lined with vinyl, rubber, or epoxies). Although not as versatile as methods which fabricate by forming and welding plastics sheet, the process seems particularly attractive for the production of relatively low volumes of specially designed as well as standard tanks.

Boats: Perhaps the most spectacular items produced by the Engel process are small pleasure boats in lengths up to 10 feet. Such boats have been used in Europe for some time, and are in the same price range as aluminum and reinforced polyester boats. Price for the Europe-produced pleasure boat shown on p. 87 ranges from $100 to $150 for the 8-ft. model; $200 to $300 for the 10-footer.

As these applications indicate, there is considerable market potential for the new process. The work already done in Europe provides a good basis for further development. What is most needed, now that the process is available in the United States, is for design to catch up with technology. Such design progress can be expected to become evident in the not too distant future. When it does, the Engel process will become an important factor in the plastics economy, bringing the benefits of polyethylene into areas which in the past had to rely on less satisfactory materials.—**End**

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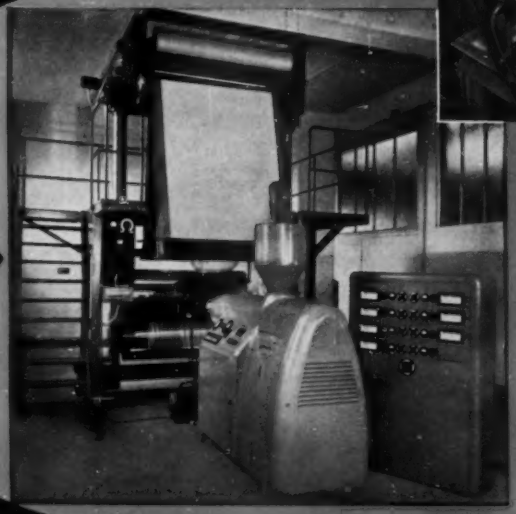

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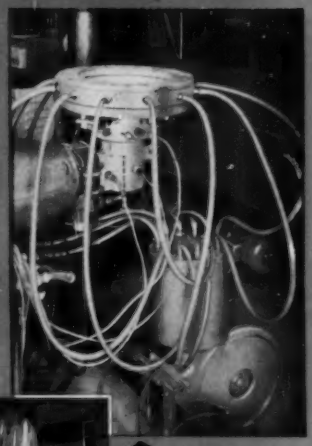

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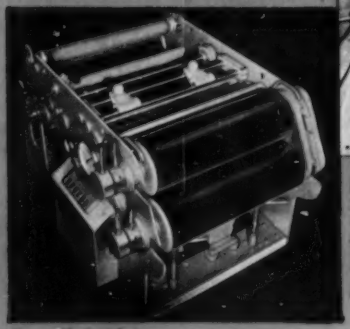

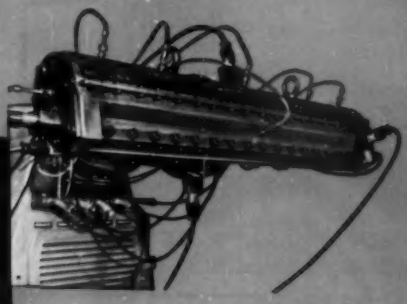

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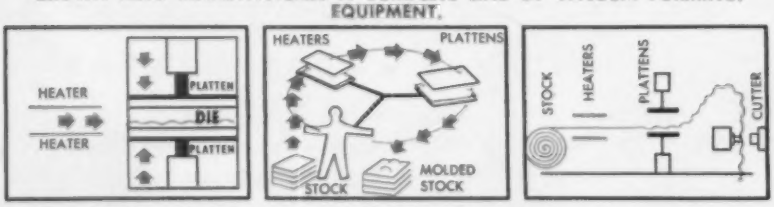

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Sandwich structures

(*From pp. 92-96*)

sandwich whose honeycomb core is "loaded" with a light weight artificial dielectric (such as aluminum coated ceramic beads) having the same dielectric constant as the skins. This construction is more difficult to fabricate, but offers the electrical advantage of the solid laminate type radome at half its weight.

Douglas Aircraft, Santa Monica, Calif., has developed an interesting technique for producing laminate structures that eliminates the customary practice of bonding laminate skins to both sides of a foam or honeycomb core. In this process, now being used for virtually all the plastic sandwich structures in the new DC-8 jetliner, a modification of the familiar lost-wax process utilizes wax castings as the mold around which the laminate is formed. Details are presented in MPI, Feb. 1960, p. 92.

Brunswick - Balke - Collender Co., Marion, Va., and Dumont Mfg. Corp., San Rafael, Calif., are among a number of other companies doing extensive work with plastic honeycomb constructions in the aircraft, missile, and related fields. Among typical aircraft parts made by Brunswick, some of which are shown in accompanying photos, are radomes, bomb-bay doors, bulkheads, partitions, elevators, rudders, tables, access doors, floor panels, utility racks, flaps, fuselage sections, wing tips, shelving, and fin tips, plus various other structural and non-structural items.

The use of honeycomb cores arises from several factors. It yields the highest strength-to-weight ratio for the materials involved. Almost any commonly used structural material, including plastics, may be fabricated in a honeycomb configuration.

Fibrous glass cloth was the basic material used for the first production quantities of honeycomb made by Hexcel Products Inc., Berkeley, Calif., now one of the world's largest producers of honeycomb products. Hexcel manufactures honeycomb not only from reinforced plastics, but also from aluminum, stainless steel,

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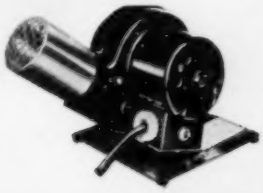

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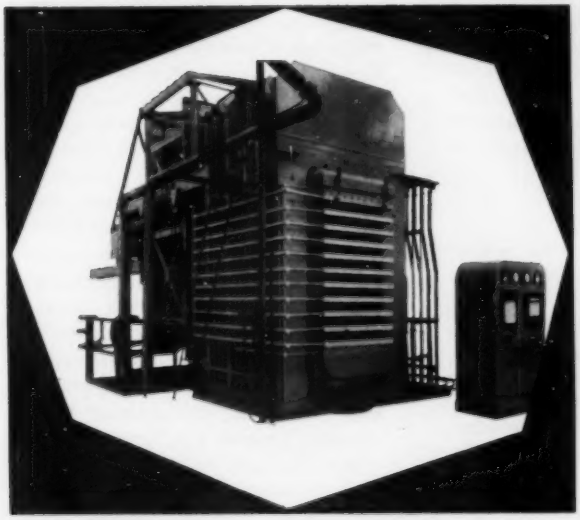

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paper, and any type material which can be produced in web form.

Glass fabric-plastic honeycomb is useful in many sandwich constructions because it embodies low dielectric properties, along with high strength and insulating qualities. Invaluable for aircraft radar housings and microwave transmission windows, it is also used as a structural material because of its heat resistance properties.

Bonded panels have strength properties which, except in tension, equal or exceed those of riveted or welded panels. In addition, the adhesive used in the bonding process provides a damping blanket that reduces vibration. Adhesive bonding and honeycomb construction also can reduce production costs by eliminating hundreds of bolts and rivets with their attendant problems of alignment, countersinking, setting, and inspection. Adhesive bonding and honeycomb construction in one case cited by Northrup Aircraft Inc. reduced the number of parts to be assembled from 3000 to 300.

In the production of glass-plastic honeycomb material, glass cloth is impregnated with a resin such as polyester or epoxy, fabricated to a honeycomb structure, expanded, cured, and repeatedly coated with additional resin. It is generally available in cell sizes from 3/16 to 3/4 in. and in panel thicknesses from 0.060 to 18 inches. These materials are usually furnished in blocks or slices, though some manufacturers mold them to specified contours.

Low-cost, paper-core honeycomb material is usually impregnated with phenolic resin for added strength and stiffness. In the production of aluminum honeycomb, the foil layers, in gages ranging from 0.0007 to 0.006 in., are bonded with vinyl-phenolic type resins. Aluminum honeycomb can be purchased either in expanded form or as HOBE (honeycomb before expansion), which is expanded before being bonded to the exterior skins. In either form, it can be machined to required shapes when contoured surfaces are involved.

Among the specialized adhesives used in honeycomb sandwich construction are combinations of thermosetting resins and elastomeric polymers, epoxy resins, epoxy-phenolic systems, and duplex tapes, consisting of a supported film of B-stage adhesive.

Narmco Resins & Coatings Co., Costa Mesa, Calif., recently announced Metlbond 406, a new adhesive adaptable to both sandwich structures and metal-to-metal bonds. Supplied in the form of an unsupported, calendered "tape" 18 in. wide, the material can be cut to the shape of areas to be bonded. Although dry, pliable, and easy to handle at room temperatures, it momentarily softens and flows at elevated temperatures, wetting the bonding surfaces. With continued application of heat and pressure, the adhesive cures into a tough, high-strength film capable of maintaining excellent bond strengths up to 200° F.

One of the earliest limitations of sandwich structure was its inability to withstand high local compressive stresses at attachment points and along panel edges. These difficulties have been overcome through development of load bearing inserts and suitable edge designs. Prefabricated inserts and edging may be of wood, metal, reinforced plastic, or other materials, or plastic putties (usually polyester or epoxy with fillers) may be used. To avoid undue stress concentrations, fittings and attachments are adhesive bonded to the sandwich either directly or through an insert.

Tooling

Even in the fast growing field of plastic tooling, the versatile plastic sandwich structure is making its influence felt. Companies such as North American Aviation are using metal and paper honeycomb in fabricating plastic tools to make a light weight unit which retains the necessary stiffness and dimensional stability.

The plastic structural sandwich may not be the answer to every problem facing the appliance industry, the construction field, and manufacturers turning out such diverse products as boats, truck and trailer bodies, and furniture. These sandwiches, with their limitless choice of desirable properties, appeal to so many tastes that even better things can be expected in the future.—**End**

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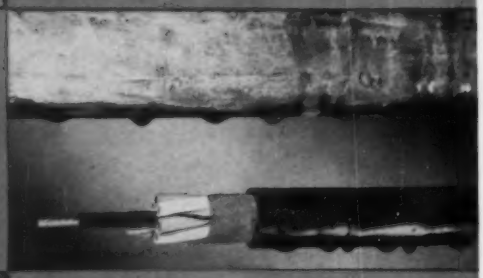

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STEAM PRE-EXPANDER. 13-page illustrated catalogue brochure provides general and technical information on machinery designed to produce expanded-in-place polystyrene, with controlled densities, by the application of steam. Polystyrene Machinery Div., Miller & Van Winkle Co. (C-005)

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POLYMERIC PLASTICIZER. 6-page bulletin describes features of a non-migratory plasticizer, its processing characteristics, compatibility, low volatility. Resistant to extraction by water, oil, and gasoline. One of its applications is said to be as a preventative in windshield fogging on automobiles. Specifications, technical information. Harchem Div., Wallace & Tiernan, Inc. (C-019)

CHINA CLAY FOR COMMERCIAL APPLICATION. 12-page brochure describes features and advantages of the application of a certain type of china clay to supplement the physical properties of low, medium, and high unsaturated, reinforced polyesters. Technical information, charts, specifications. Georgia Kaolin Co. (C-020)

BLOW MOLDING MACHINES. 4-page illustrated brochure describes line of machines that mold parts to 14 in. in diameter and 36 in. in length at dry cycle rates up to 14,000 parts per hour. Auto-Blow Corp. (C-021)

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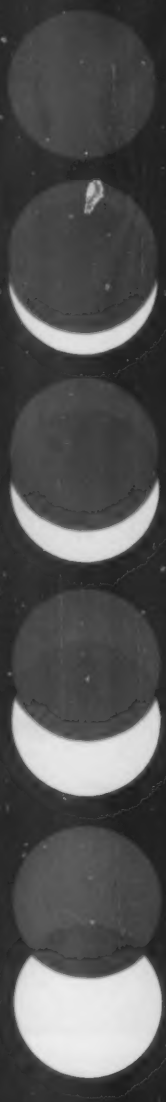

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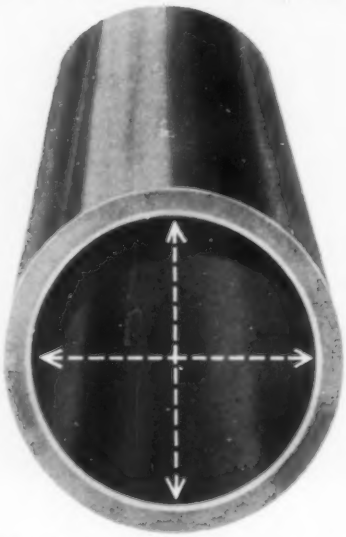

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Tumbling

(*From pp. 109-112*)

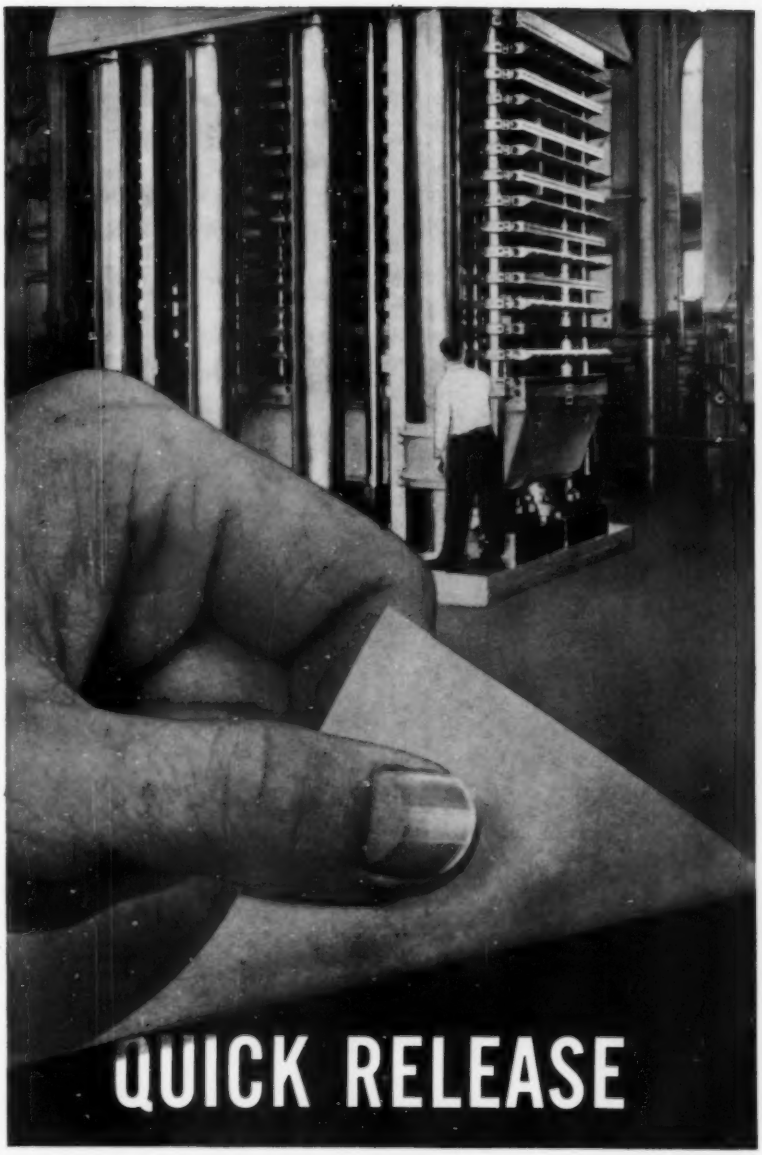
of the barrel's volume. Occasionally, when larger pieces are to be tumbled, it may be necessary to increase the load to about 85% of capacity. But unless absolutely necessary such heavy loading should be avoided, since it will generally slow down the finishing action, will require longer tumbling times, and will lower the production thruput.

There is no ironclad rule covering the relation of amount of work pieces, amount of media, and load. Since it is generally desirable to surround each work piece with media, a greater volume of media than of the work pieces is often used. When the specific gravity of the pieces and the media are nearly equal, a 1:1 ratio may ordinarily be suitable. When large parts are being tumbled, it is usually advisable to increase the ratio of media to parts to provide a better coverage of the parts. This results in better cushioning between parts and helps prevent direct part-to-part contact and possible damage.

In addition, both the shape and the finish of the pieces will govern the formulation of the load. Generally, for most satisfactory results, the combination of medium, compound, and speed should be determined by experimentally processing a sample of the new job. Based on the experimental results of such trials, Table III, p. 112, can be used as a guide in selecting initial systems and conditions to be used for processing some thermoplastics.

Summary

As has been pointed out, tumbling may be the economical solution to some thermoplastic part finishing problems. It is generally most suited to large-volume small items that are manufactured on a continuing basis and that require a deburring or polishing operation to put the finishing touches on the product. Most thermoplastics can be tumble-finished once the proper tumbling system is developed. The tumbling equipment manufacturer is willing to work out the details and should be consulted in view of the many variables involved.—**End**



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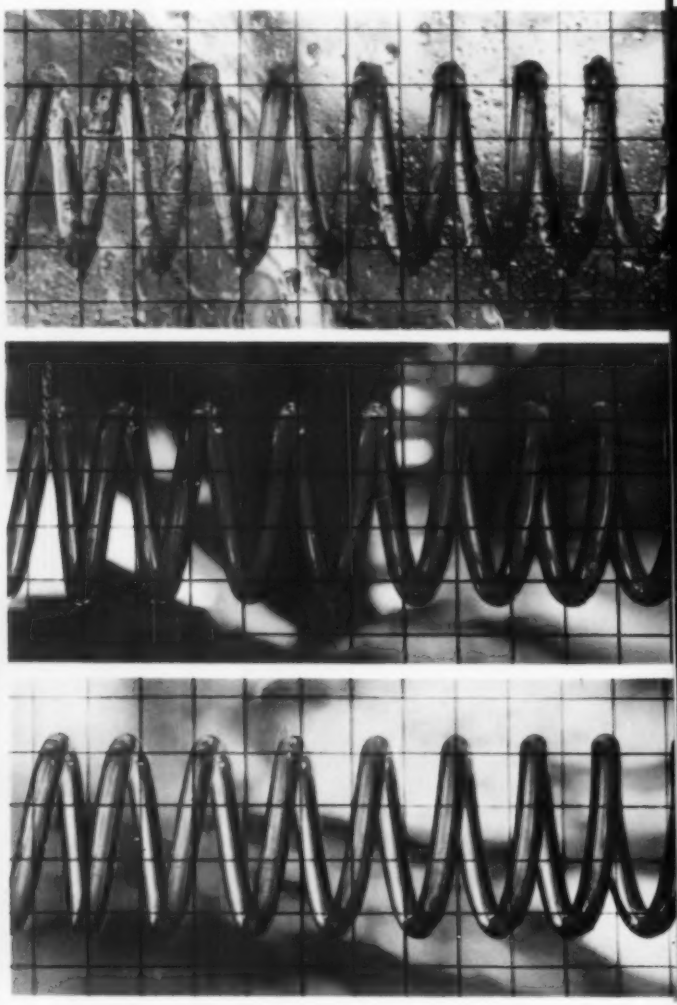

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PROPERTY	ASTM NO.	VALUE*
MECHANICAL		
Impact strength, Izod (notched)	D-256 (½" x ½")	2 to 3 ft-lb/in.
	(½" x ⅛")	12 to 16 ft-lb/in.
Tensile strength and yield point	D-638	8,000-9,000 psi
Elongation, at yield	D-638	5-6%
Elongation, ultimate	D-638	60-100%
Compressive stress at yield point	D-695	12,000 psi
Deformation under load	D-621	0.14%
Flexural strength	D-790	11,000-13,000 psi
Modulus of elasticity		
Tension	D-638	2.8-3.2 x 10^5 psi
Flexural	D-740	3.2-3.4 x 10^5 psi
Rockwell hardness	D-785	R 115
ELECTRICAL		
Dielectric constant	D-150	
60 cycles		2.95
10^6 cycles		2.90
Dielectric strength, short time	D-149	440 V/mil
Dissipation factor		
60 cycles	D-150	0.0007
10^6 cycles		0.0100
Volume resistivity		
Dry		1.2 x 10^{16} ohm/cm
4 days at 80% rel. humidity		9 x 10^{14} ohm/cm
Arc resistance	D-495	12 sec

PROPERTY	ASTM NO.	VALUE*
THERMAL		
Heat distortion	D-648	
264 psi		280°F
66 psi		290°F
Specific heat		0.28 cal/°C/gm
Coeff. of expansion	D-696	7 x 10^{-5} in./in./°C
Melting temperature		425-440°F
Crystalline melting temp.		505°F
Flammability (in./min)	D-635	Self-extinguishing
MISCELLANEOUS		
Specific gravity	D-792	1.20
Refractive index	D-542	1.587 $N_{D}^{25°C}$
Clarity		Transparent
Water absorption 24 hr immersion	D-570	0.3%
Effect of sunlight		None to slight
Outdoor aging		Good

*These values have been obtained under standard ASTM and laboratory test conditions. As averages, these values do not necessarily represent minimum material specifications.

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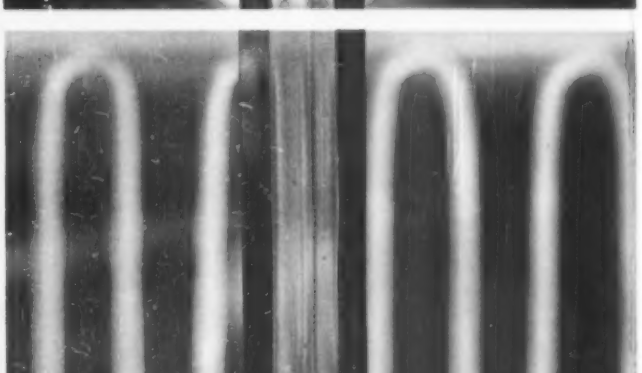

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Thermal and shear

(*From pp. 116-123*)

The high-density Marlex was not changed by extrusions at 325° F. However, at 525° F., the apparent melt viscosity of Marlex increased with each extrusion. The total increase after the tenth extrusion was 29 percent. Repeated extrusions of Dow low-density PE at 646° F. lowered the apparent melt viscosity with each pass. Total decrease after the tenth extrusion was 56 percent. Both the increase in apparent melt viscosity of the high-density resin extruded at 525° F. and the decrease in apparent melt viscosity of the low-density resin extruded at 646° F. were due to high temperature and possibly oxidation, rather than to shear.

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Rheological

(From pp. 131-134)

processing will be best only when the proper combination of temperature, plasticizer concentration, resin molecular weight, and shear rate are attained such that the fluidity or viscosity of the stock at the final calendering bank is within a limited range.

Some laboratory calender experiments have given supporting evidence in confirmation of this hypothesis. Four plasticized vinyl resins ranging in specific viscosity from 0.50 to 0.31 were mixed and calendered on a 4-roll 8 by 16 in. laboratory calender. Roll temperatures were adjusted to give optimum conditions as judged by processing behavior and appearance of the calendered sheet. Calender roll speed and nip were kept constant for all tests. The final calendering bank temperature was assumed to be the average of the middle and bottom roll temperatures. The appropriate specific viscosity, temperature, and plasticizer data for each compound were used in Eq. 3 to calculate R_e. The results are shown in Table II, p. 132.

The calculated values of R_e do not vary from the average by more than 8% which is considered within the estimated variation of the experimental data. In effect this means that the temperature change required for optimum calendering varies with the molecular weight or specific viscosity in accordance with Eq. 3 which was obtained from viscometry data.

Discussion

There are four primary factors that influence the flow characteristic, defined as viscosity, of a plasticized vinyl resin undergoing simple shear. The qualitative effects produced by independent variation in these four factors on the viscosity are well known; namely: 1) increasing shear rate produces a decrease in viscosity, 2) increasing temperature decreases viscosity, 3) increasing plasticizer content decreases viscosity, and, finally, 4) decreasing the effective molecular weight decreases viscosity.

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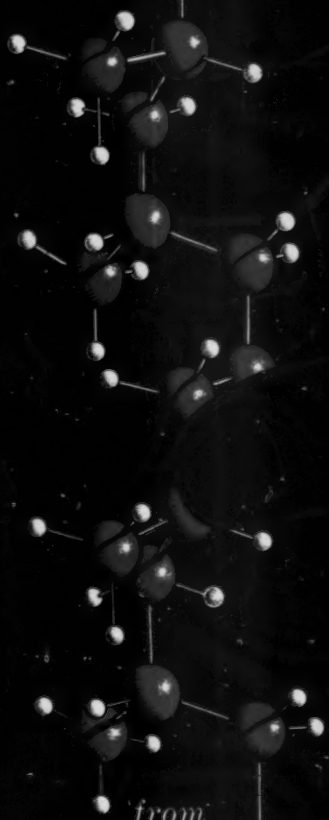

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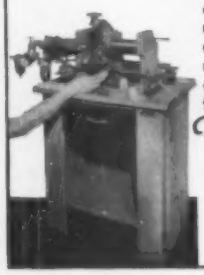

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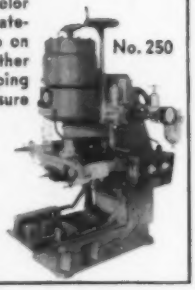

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that influence the viscosity but, for this rheological study, the influence of other factors was minimized in order to measure quantitatively the effects of the above four factors.

The empirical equation that was developed from the viscometry work at a single speed showed that the effect of temperature, plasticizer content, and molecular weight could be quantitatively related. The multi-speed viscometry indicated that the absolute viscosities over a 10-fold range in shear rates varied in a manner similar to that found for the viscometer dial readings at a single rotor speed. Since very little is known about the magnitude or range of shear rates for passage of stock through the final bank and nip, direct application to calendering of the equation developed from the viscometry work is not anticipated. However, as shown by the application to the laboratory calendering results, reasonable estimates of calendering conditions can be evaluated.

In other work, this quantitative relation has been helpful in such problems as whether the maximum temperature of calender rolls was sufficient to permit calendering unplasticized high molecular weight resin. Also, in the problem of temperature differential between the center section and ends of a calender roll, say of 9° F., it can be shown that this differential is equivalent to altering the resin molecular weight by approximately 0.04 specific viscosity units, or by changing the plasticizer content by four parts of DOP.

The constants developed in this work for DOP and vinyl resins are known to change when another plasticizer is used, as will be shown in another paper. In exploratory viscometry work with other types of plastics, the same general type of relationship has been found but the experimental data are insufficient to show any quantitative results.

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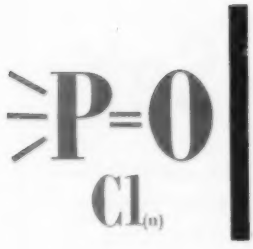

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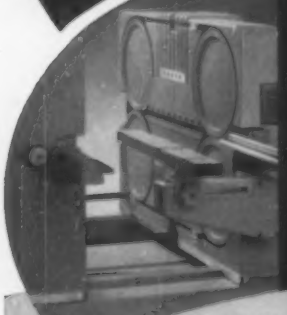

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Olefin-terpene

(From pp. 137-150)

the use of diluents will reduce the heat distortion temperatures.

The advantages of coatings modified with the olefins and terpene oxides immediately apparent are: 1) low order of toxicity, 2) reduction of viscosity while maintaining equivalent solids content, 3) increased pot life, 4) comparable tack-free time and Taber abrasion resistance, and 5) shorter time to attain maximum impact and flexibility. Coatings containing the olefin oxides yield Sward hardness values and chemical and solvent resistance comparable to the control. Coatings containing C_{16}-C_{18} olefin oxides appear to offer excellent resistance to steam and cold water cycles.

These epoxides are but the first of many of the nonglycidyl type that will be offered to the epoxy resin field. And it is envisioned that epoxides, tailor-made for specific needs, will soon be available to formulators.

Acknowledgment

The authors wish to express their gratitude to Dr. H. K. Latourette for his suggestions and review of this paper.

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Plastics heels

(From pp. 152-156)

is taken to maintain it in proper condition and adjustment, since only in this way can consistent test results be derived from its use. The location and orientation of the heel during brad insertion is as shown in the figure. The brads, 0.040-in. diameter and ⅜-in. long, penetrate the heel to a depth of 3/16 in. being driven by a hydraulic force of 2000 lb. in approximately ⅛ second. The blunt-end brads are formed from cold-drawn SAE 108 steel wire, again in keeping with commercial practice, though the use of pointed nails for plastics heels would be highly desirable. An unskilled operator can test 250 heels per hour.

The test is applied to molded heels that have been finished or lacquered. Cracks that immediately form are obvious, whereas those that would form upon subsequent aging or in storage can be hastened by exposure to modestly elevated temperatures; a few hours at 120 to 140° F. are qualitatively equivalent to perhaps several weeks at room temperature and even higher temperatures can be used if it is desired to rank heels that show no immediate fractures during the test.

From this test it has become apparent that annealing all types of plastics after molding and before lacquering is desirable to minimize cracks from nailing. This point is least critical with cellulose acetate and butyrate, of more importance to the modified acrylics, and crucial with respect to the styrene-based compositions which are of generally poor performance in the test. A failure to anneal before lacquering also has a bad effect on the impact strength of all three classes of materials. Though toplift attachment by nailing is no longer common, our use of this test continues because of the information it produces with respect to proper lacquer formulation, annealing conditions, and molding cycles.

Flexural fatigue

The flexural fatigue tester, Fig. 6, p. 156, attempts to evaluate, by exaggeration, the consequences of attachment and improper treading

previously described. At room tem-

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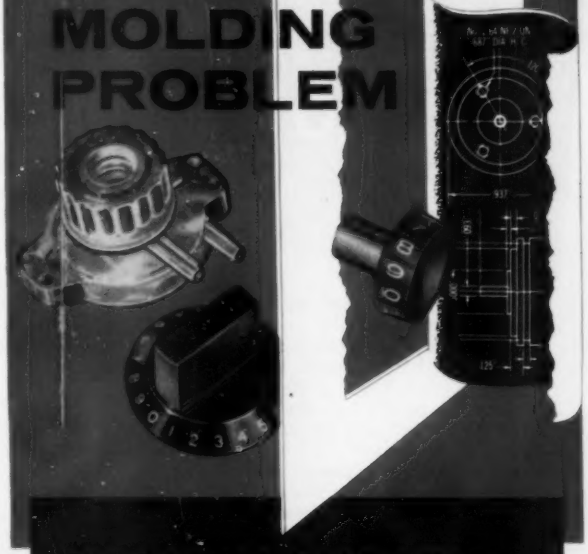

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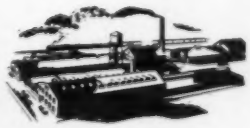

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previously described. At room temperature, constant force blows of 120 lb. are pneumatically applied 110 times per minute at a large angle to the heel axis, to ensure that yielding or plastic flow occurs at the minimum cross-section of the heel stem. Automatically recorded is the number of cycles to failure, which can consist of either actual fracture or progressive deformation to a degree that is considered intolerable.

This test is surprisingly discriminating and, in our experience, correlates directly with field service. For example, no commercial formulations of impact styrene yet examined will endure more than a few hundred cycles before fracturing, in contrast to butyrate, which will take 700 to 1000 cycles before reaching the limit deformation, or the modified acrylics, which eventually fail at 6000 to 9000 cycles. If steel dowels are used with these materials, the differences in performance are greatly reduced and when failure does not occur by 12,000 to 13,000 cycles, the test is discontinued and the design is judged acceptable. This statement should not be construed to mean that merely any dowel has such a beneficial effect; as a case in point, one styrene formulation recently tested consistently fractured at approximately 7500 cycles until an apparently minor change in the dowel design resulted in tests still satisfactory when discontinued at 17,000 cycles. It should be added that such sensitivity to dowel design appears to be very characteristic of the impact styrenes generally, in contrast to the cellulosic and acrylic formulations.

The flexural fatigue apparatus required an expensive and lengthy development, but in its present form it can be duplicated quite cheaply. For this reason, several of them are used simultaneously and the evaluation of a new heel combination now requires perhaps 16 to 25 hr., during most of which time the unskilled operator is available for other work since the machines are self-controlled.

The authors wish to express gratitude to the Fred W. Mears Heel Co. Inc. and to the United Shoe Machinery Corp. for permission to publish this paper. —End

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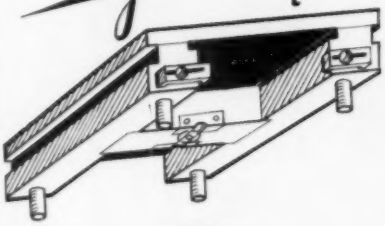

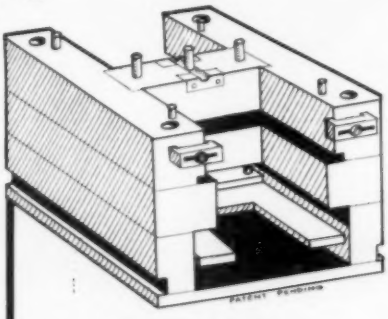

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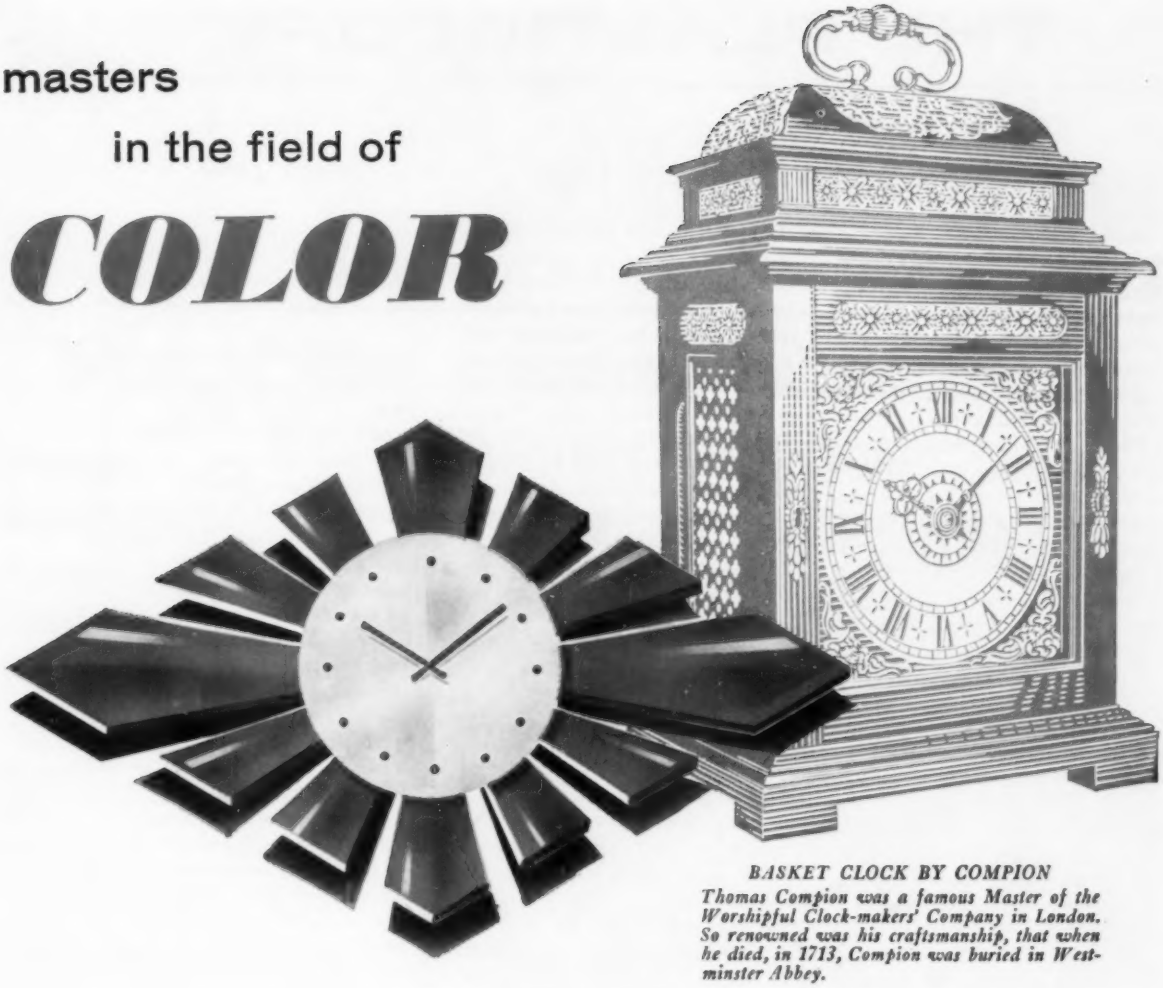

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News and interpretations of the news

By R. L. Van Boskirk

Section 2 *(Section 1 starts on p. 37)*

March 1960

Spencer's new film grade resin

When a Spencer Chemical Co. representative was recently asked: "What does all this talk about your polymorphous film grade resin really mean?" the answer came as follows:

"Well, sir, to use baseball terminology, this puts us in the first division among suppliers of film grade resin. We could even go all the way and win the pennant with it." To those who know the history of Spencer's struggle to develop a top grade film resin, this is indeed a significant statement.

There is no easy way to describe this new material in layman's terms. It seems to center around crystallization which is a term the chemists use to confound their non-chemist acquaintances—like doctors use fancy talk about patients' ailments. For one thing, low-pressure-processed polyethylene has up to 90% crystallization in the 0.960 density resin —it's the main factor in creating stiffness—but, it also can result in easy tear in one direction.

The smaller the crystal, the better the clarity. Crystallinity is involved in chilled roll casting where small crystals result in better clarity but straight-line tear is a problem. Crystallization, in this case, occurs during the cooling stage—fast cooling creates clarity but the crystals must be kept small and have good distribution.

The density of the Spencer resin is only 0.920. The growth of crystals is controlled during film extrusion. They remain small to give clarity and the degree of crystallization remains low enough to give toughness. Earlier polyethylenes in this density were characterized either by a higher percentage crystallinity (about 70%) and small crystallite size or by a lower percentage crystallinity (about 50%) and large crystallites. The high percentage led to low impact and the large size led to opacity, haze and poor opticals. The new polymorphous polyethylene has about 50% crystallinity combined with small crystallites. It is a balance of relatively linear chains of high molecular weight and highly branched chains of low molecular weight. The film may be likened to polyethylene-coated glass scrim in which the crystallites serve as tie-points or knots which hold the cords (uncrystallized parts) together. The cord receives the impact and gives but the knots hold it together. The knots or crystallites can't get big because the short-branched molecules crowd against them.

The claimed result is a general-purpose film that gives improved impact, puncture resistance, lack of straight-line tear, high clarity and lack of haze that can be produced by either a blown or chilled roll technique.

An extra dividend that is claimed is high speed of extrusion and ease of processing. It is said that resin properties are relatively insensitive to blow-up ratio, extrusion speed, temperature. A man can't run away and let the machine run forever without attention, but according to Spencer Chemical: "it's the easiest stuff to run you'll ever see."

Cycolac price drop

Marbon Chemical Div., Borg-Warner Corp., Washington, W. Va., announces that as of March 1, 1960, the price of natural and black Cycolac in truckload quantities (20,000 lb.) is reduced from 58¢/lb. to 49 cents. Standard and custom colored Cycolac in similar quantities is lowered from 58¢/lb. to 51 cents.

These are pelleted molding and extrusion grade materials. Cycolac powder for calendering drops from 53¢/lb. to 45¢ in truckload quantities, natural color. Reason for these price reductions: to expand into markets not now dominated by any other plastic. Replacement of die-castings is a typical example.

Non-toxic stabilizers for vinyl

Three new vinyl chloride stabilizers, claimed to result in a material recognized as safe by F.D.A., have been announced by Argus Chemical Corp. Brooklyn, N. Y. Designated Mark 33, Mark 34, and Mark 35 materials, they may be used in either plasticized or unplasticized (rigid) vinyl chloride but are said to be particularly effective in the stabilization of rigid vinyl compounds.

Development of these new stabilizers could be another milestone in the development of rigid vinyl for more widespread use in the food packaging industry where they are now being evaluated for unplasticized, extruded thin film 1 mil thick. Barrier properties and ease of printing of unplasticized vinyl chloride film make it an ideal product for many food packaging applications, but a non-toxic stabilizer that would prevent vinyl from breaking down in the extruder at the high heat that is required for processing has not been easily available.

Barium cadmiums lead salts, and alkyl tin mercaptides are the most commonly used stabilizers for vinyl, but they do not have FDA approval for non-toxicity.

One of the interesting features of the new stabilizers is that they give good stability in rigid compounds without the necessity of adding epoxidized oils and thus eliminate loss of heat distortion and other properties that accompany the use of liquid type plasticizers or stabilizers when used in rigids. Optimum stability can be obtained by using 5.0 parts of stabilizer, for 100 parts of resin but 2.0-4.0 p.h.r. is generally adequate. These new stabilizers are unique in that increased stability can be obtained by raising the stabilizer level, which is contrary **(To page 210)**

* Reg. U. S. Pat. Off.

News about R&A SINCE 1913 **Adhesives**

FOR ALL METALS AND ALL PLASTICS

Which of these pressure sensitive adhesives meet your "specs"?

8 typical Bond*master*® *pressure sensitive adhesives:*

BONDMASTER P538: Used to make high-strength, superior aging flatback and crepe paper general purpose tapes and creep-resistant packaging tapes (reinforced and unreinforced) as well as flatback printable tape. 2-part.

BONDMASTER P549: Used to bond Pliofilm and other thin plastics without wrinkling or curling the film.

BONDMASTER P552: Used to manufacture general purpose pressure sensitive coated products and tapes of various types. Combines good creep-resistance at room and elevated temperatures with aggressive tack.

BONDMASTER P558: Widely used for manufacture of pressure sensitive cloth tapes for the shoe and athletic goods industries. Does not strike through open weave fabrics.

BONDMASTER P561: Firm; specifically formulated for vinyl decorative wall coverings.

BONDMASTER P566: Suitable for thin vinyl surgical bandages and tapes.

BONDMASTER P594: Clear, firm, flexible; widely used to coat lightweight materials such as plain, metallized or coated papers; felt; cloth; plastics, etc. Non-staining.

BONDMASTER P595: A **balanced** 2-part mass. Causes virtually no discoloration when placed in contact with most sensitive colors during paint bake cycles. Does not transfer or leave adhesive residue when repositioned.

WRITE FOR DETAILED TECHNICAL DATA

R&A SINCE 1913

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Masking tape manufacturers demand that our BONDMASTER formulations enable them to produce a product which:

1. Develops high bond strength to almost all surfaces immediately after the tape is applied . . . with only slight pressure required to make a bond strong enough to tear fibers when stripped from surfaces such as paper, cardboard, etc.
2. Withstands creep under constant loads, yet strips cleanly from smooth, hard surfaces without leaving any residue.
3. Will follow and hold to contours—for example, can be bent around a small radius without any slipping or pulling away for long periods of time.
4. Will not affect the color of a wide variety of sensitive surfaces (e.g., pastel paints).
5. Will maintain their excellent pressure sensitive properties under hot and cold storage conditions and after exposure to accelerated aging as well as to outdoor weathering.

"NON-MASKING" REQUIREMENTS

Manufacturers working with thin films demand an adhesive which won't curl the plastic . . . those who use open weave fabrics need a formulation that won't strike through . . . producers of coated glass cloth and varnished cambric electrical insulating materials require that bonds maintain satisfactory strength after accelerated high temperature aging . . . the adhesive used for surgical bandages must withstand steam sterilization.

Vinyl decorative wall coverings present a host of requirements which the adhesive must meet . . . not the least of which is the matter of cost-per-square-yard of finished product!

The full line of BONDMASTER Series "P" liquid pressure sensitive adhesives features over 20 different formulations developed for specific end-uses. Chances are, there's a *standard* product in our line that can bring an efficient and economical solution to *your* production problems in this field.

THE PLASTISCOPE

(From page 208)

to results generally obtained with non-toxic stabilizers in plasticized vinyl compounds.

It is not claimed that crystal clarity can be obtained in thick sections; but in thin sections it is adequate for most any application.

The ability to use these stabilizers without any other liquid additive allows the compounder to select lower molecular weight resins than usual and thus gives the advantage of processing at lower temperatures. The lower impact of low molecular weight resins is compensated for by using a solid stabilizer which combined formulations form a compound claimed to have superior qualities to those that can be attained with high molecular weight resins and liquid type stabilizers.

Mark 33 is said to provide long-term heat stability in rigids but is yellowish-orange and is best suited for dark compounds such as potable water pipe.

Mark 34, in paste form, is used where initial color is of primary importance, but its long-term stability is less than Mark 33. It is suggested for compounds that do not require a severe heat history, but it is the best of all three stabilizers for clarity.

Mark 35 is a compromise between the two and the slight yellow color can be overcome by proper pigmentation.

The price of these new Argus stabilizers is $1.00 a pound. Tin mercaptides are $2.75 to $3.00 a pound, and barium-cadmiums are 62 cents.

In-situ epoxidation

Becco Chemical Div. of Food Machinery & Chemical Corp., Buffalo, N. Y. has been granted U. S. Patent No. 2,919,283 covering a process for in-situ epoxidation. The process uses ion-exchange peroxide as the oxidant.

The process, which eliminates the necessity for using preformed peracids (such as peracetic acid), permits fatty acid esters to be used with hydrogen peroxide to yield plasticizers for vinyl resins and others. It was developed by Becco in 1954. Millions of pounds of epoxy plasticizers have already been produced by this process by a number of prominent companies in the industry, according to Becco.

Eastman inhibitors

Two of the new ultraviolet inhibitors to be marketed by Eastman Chemical Products Inc. are reported as showing promise as antioxidants for polyolefins and paraffins. One, called THBP, a butyrophenone derivative, can be added to polyethylene, polypropylene, and paraffin waxes during milling or as dispersion. Tests indicate that when 0.1% is added, PE is more than 2½ times as stable to oxidation deterioration as untreated material.

Inhibitor OPS (p-octylphenyl salicylate), intended for polyethylene and polypropylene, serves to reduce photo-oxidation and accompanying degradation when polyolefins are exposed to sunlight. It is said to have good compatibility with the resins in contrast to many others that have been tried.

Inhibitor HPT is a non-absorbing type ultraviolet stabilizer for vinyl chloride. It is clear, light yellow, and soluble in water, plasticizers, and solvents. Tests reported by Eastman indicate that vinyl has been protected against 7 years outdoor weathering when using HPT. It is strictly an ultraviolet stabilizer and is not intended as a heat stabilizer.

The benzoate RMB is an ultraviolet stabilizer for cellulosics. It does not impart color to the plastic, thus permitting use in transparent materials.

Special purpose stabilizers

Three new PVC stabilizers for use where severe processing conditions are encountered have been announced by Ferro Chemical Corp. Ferro 2035, suggested by the company for high-temperature, high-speed processing cycles, is said to be a highly efficient heat and light stabilizer that provides maximum resistance to color drift and outstanding long-term heat stability. It is claimed to resist roll plateout and to be nonpinking in whites and pastels.

Ferro 1772, a liquid cadmium-zinc stabilizer containing auxiliary organic stabilizer components, is recommended for clear, pigmented, and filled plastisol formulations. High-clarity water-white vinyls may be reportedly obtained with this compound in unfilled, unpigmented formulations. It is stated to be resistant to plateout or mold deposits.

Ferro 18.9L-S comprises a special two-component vinyl heat stabilizing system containing barium, cadmium, and zinc compounds combined with organic stabilizers. Ferro 1879L is a straw-colored liquid and Ferro 1879S is a white powder. This stabilizer system is recommended primarily for use in the heat stabilization of clear, semi-rigid compounds; however, it may also be used in any plasticized clear or pigmented formulation. The system is claimed to have good light stability, and clear semi-rigids stabilized which are said to resist the tendency toward early light yellowing after exposure to ultraviolet light.

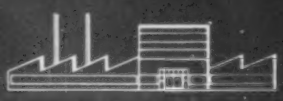
White lead stabilizer

Basic lead carbonate powder and pastes for PVC stabilization are being offered by South American Minerals & Merchandise Corp., New York, N. Y.

Dispersion into liquid plasticizers is carried out by a specially developed transfer operation whch entirely avoids the need to dry out the water from the precipitated slurry. In this way complete wetting of the white lead particles by the liquid plasticizer is achieved. The value of the dispersion technique is indicated by Samincorp's tests, which the company says will hold heat stability for 45 min. compared to 30 min. when lead is used as powder.

The two principal grades are known as Medium Stain and High Stain, a terminology derived from the resistance of the two grades to staining by colored pigments. From the stability point of view High Stain provides longer heat stability. Adequate stability is achieved by using 5 parts or less to 100 parts **(To page 212)**

SUPPLIERS OF RAW MATERIALS
TO THE PLASTICS INDUSTRY



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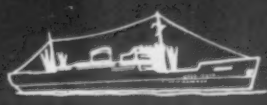

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TEL: PLAZA 1-4280 CABLE ADDRESS: INPLAKO

THE PLASTISCOPE

(From page 210)

of polymer. All grades of white lead stabilizers impart (white) opacity to PVC compounds, often rendering the additional use of inert white opacifying pigments unnecessary. High Stain exerts a greater opacifying effect than Medium Stain. High Stain pastes are more viscous. The dispersion technique employed in manufacture of Samincorp stabilizers generally overcomes the problem of settling or separation.

While not intended specifically for rendering PVC compounds immune to the effect of ultraviolet light, white lead does afford some protection against light due to its ability to react with the acidic breakdown products of ultraviolet degradation. It is particularly useful when used in conjunction with certain specific light stabilizers, owing to a synergistic effect which can raise light and heat stabilizing action above that obtained with the separate stabilizers.

Epoxies with a difference

A family of epoxy resins which differ from conventional epoxies in structure, reactivity, and end properties has been introduced by Food Machinery & Chemical Corp. The new resins are epoxidized polyolefins rather than epichlorohydrin bisphenol condensates. As a result of this molecular construction, many epoxy groups capable of reaction are located internally and externally along the basic hydrocarbon chain. Conventional epoxy resins possess only terminal epoxy groups. FMC's resins, called the Oxiron series, are polyfunctional, showing unusual versatility for curing through multiple epoxy and hydroxy groups and also through double bonds.

For insulating and encapsulating applications, anhydrides are the preferred curing agents. Oxiron polyamine cure systems are said to show long pot life, suggesting wet lay-up and prepeg use. Combination peroxide-anhydride-glycol cures give high heat distortion point resins, the company states. The series of epoxy resins introduced by FMC differ from each other mainly in viscosity. Oxiron 2000 has a viscosity of 1800 cps. at 25° C.; Oxiron 2001 has a viscosity of 160; and Oxiron 2002, a viscosity of 15 cps.

High-density PE for coating

Development of markets for high-density (linear) polyethylene may have seemed slow in view of the gigantic publicity build-up before the material was even ready for distribution; but producers are now building up specialized markets one by one that give promise of volume sales that may soon require a great portion of all the resin available.

The first to develop in reasonably large volume and still growing is molded housewares. The second, which is held back only by lack of adequate facilities for processing, is blown bottles for detergents. The third promising item is the 5 or 6 mil bag for heavy duty bulk handling. And now Union Carbide Plastics has come through with a coating material for use in multiwall bags. It may take some time to achieve big volume for a small quantity of resin coats a large area of paper, but the possibilities are there for consumption of many millions of pounds. This material, designated DGDD-7401 Natural, virtually cuts in half the coating weights required to give paper impermeability to moisture, grease, and oils. It can be extruded at good speed in coating weights as low as 6 lb. per ream. Formerly 20 lb. was the lowest practical weight with high-density polyethylene, according to Union Carbide.

International Paper Co. has commercially introduced multiwall shipping bags having a coating extruded from this material which is especially suited for such "thirsty crystal" materials as calcium chloride, fertilizers, and certain resins and compounds. Product protection is improved while packaging costs are lowered because less polyethylene is needed. Depending on bag construction, International estimates that overall savings can range from $1.50 to $14.50 per thousand bags. Laboratory data by Carbide are asserted to show that the moisture protection offered by a 6-lb. per ream high-density polyethylene coating surpasses that of asphalt/paper laminated constructions commonly used for shipping moisture-critical products—gives greater protection to the paper against deterioration —gives multiwall bags superior scuff and abrasion resistance, improved slip properties, and higher heat resistance.

PE film capacity doubles in 2 years

Polyethylene film production capacity is now 450 million lb. annually, J. L. Rodgers, Director of Sales, Union Carbide Plastics Co., told the National Flexible Packaging Association recently.

"This is double the capacity of only two years ago," he said. He warned that aggressive market development—particularly in the flexible packaging field, which accounts for 75% of all PE film—is necessary to overcome a serious overproduction problem and an accompanying poor profit picture.

The industry's annual production capacity is more than 25% higher than total film use in 1959, he pointed out. "And the capacity will continue to increase during the coming year."

The enormous rise in production capacity resulted in part from a three-fold increase in the number of film extruders since 1953, together with addition of new capacity by existing companies. Another important factor, he said, is the greatly increased productivity of modern extrusion machinery. At one time, output rates of 2½-in. extruder of 50 lb./hr. were quite common. The same size machine today often produces 100 lb./hr.

In discussing market development for film, Mr. Rodgers cited three specific areas that could add more than 100 million lb. to annual film consumption by 1963. These include the bakery field, with a potential of 60 million lb. annually and a 1958 consumption of 3 million lb; produce packaging with a 1963 potential of 100 million compared to 60 million in 1959; and packaging of paper products, with 15 million **(To page 216)**

tank-car delivery of DIISOBUTYLENE

Now in its third successful year of volume production, this Petro-Tex trimethylpentene finds important use in detergent intermediates, anti-oxidants, etc. But its reaction possibilities—such as chlorination and hydrolosis to isooctenyl alcohol—are far from fully explored.

Petro-Tex Diisobutylene has a uniquely interesting combination of properties. It is a clear water-white mixture of

2,4,4-trimethylpentene-1 $H_3C-\overset{\overset{CH_3}{|}}{\underset{\underset{CH_3}{|}}{C}}-\overset{\overset{H}{|}}{\underset{\underset{H}{|}}{C}}-\overset{\overset{CH_3}{|}}{C}=CH_2$

and 2,4,4-trimethylpentene-2 $H_3C-\overset{\overset{CH_3}{|}}{\underset{\underset{CH_3}{|}}{C}}-\overset{\overset{H}{|}}{C}=\overset{\overset{CH_3}{|}}{C}-CH_3$

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To expedite end-product research, we offer a complete technical "package" containing detailed physical properties plus a breakdown of the isomer distribution and their concentration. Our technical personnel will work with you on new applications which may lead to volume use. We also invite inquiries for

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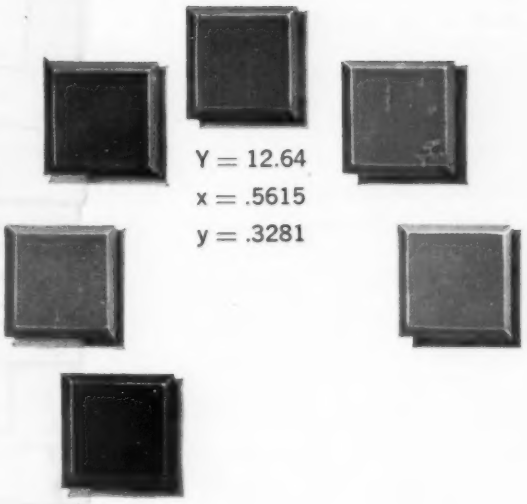
WHAT SIZE RED FOR YOU?

Monsanto's Micro-Match Colors system is a major breakthrough in plastics color technology. Styrene colors can now be matched or reproduced with accuracy and uniformity never before possible.

In this new system, spectrophotometric data is fed into a specially developed electronic computer which, in minutes, "measures" colors in precise "dimensions." Variances too minute for the human eye to distinguish can be determined and corrected. So reliable is this system, Monsanto can guarantee accuracy within specified production limits even without producing a sample chip!

Micro-Match Colors are another product of Monsanto's continuous program to establish new standards of excellence for the plastics industry. Monsanto Chemical Company, Plastics Division, Springfield 2, Mass.



Y = 12.64
x = .5615
y = .3281

Micro-Match Colors: A trademark identifying a Monsanto service.

MONSANTO INNOVATOR IN **PLASTICS**

Monsanto

THE PLASTISCOPE

(From page 212)

lb./year in 1963 against 1 million in 1959 and practically zero usage in 1958.

"The industry's key objective should be acceleration. In other words, these markets would probably grow even with a minimum of effort. The trick—and it is no small job to turn it—is to make them grow rapidly, so that demand keeps pace with the industry's booming capacity, and new opportunities for profit are opened."

Switches to urethane

Because of the rapidly expanding lines of molded urethane foam products now being made at its Dover, N. H., plant, the Davidson Rubber Co. will close its Charlestown, Mass. plant and will discontinue its molded, solid and chemically blown sponge rubber product lines. The general offices will also be moved to Dover.

Davidson, said to be the second oldest rubber company in the world, has become a major supplier of molded urethane foam products for the automotive and furniture industries. The company developed a process for making armrests from a slush molded vinyl plastisol skin with foamed-in-place urethane.

Plastics abroad

What foreign countries require an import license for plastics materials? When is an exchange permit required? What are the duty and ad valorem rates on plastics imported into the United States?

These are some of the questions discussed in a booklet, entitled "World Survey of Plastics," published by the government and prepared by the Business and Defense Services Administration.

Unfortunately, the statistics on world trade in plastics are of the 1956-57 vintage and there have been many changes since then, especially in polyethylene, but even so the booklet is well worth examination for anyone interested in foreign trade. The plastics situation all over the world, country by country, is examined in detail with statistics on each country's consumption and production together with names of firms engaged in plastics operations. Thus one learns that in Egypt there were 15 firms engaged in processing plastics and 40% of imports were polystyrene; in Mexico there were 13 affiliates of U. S. companies who produce or process plastics; in Guatamala there were 10 processors who consumed almost 850,000 lb. of plastics in 1956; that since 1953, average yearly gains of plastics materials in West Germany have approximated 90,000 tons, and more.

The booklet points out that 15 countries accounted for 76% of all imported plastics materials with Canada at 12.4%; West Germany and United Kingdom at 7% each; France at 6.1%; Japan at 5.6%, as the leaders.

The booklet may be obtained for $1.00 from the Supt. of Documents, U. S. Gov't. Printing Office, Washington 25, D. C.

Vinyl dolls

An impression that vinyl may be giving way to other thermoplastics in dolls is certainly contradicted by Uneeda Doll Co. Inc., New York, N. Y., which has launched an intensive consumer campaign to sell their 36-in. Neeta Dahl with emphasis on the fact that it is produced from vinyl. The new doll is called Miss Vinyl of 1960.

Bob Sklarsky, Uneeda VP says: "With its outstanding strength-weight ratio, seamless construction facility, and realistic complexion, true vinyl has proven itself the superior material for doll making in the world today."

Uneeda claims to have been one of the largest producers of dolls in the United States in 1959, with the vinyl variety accounting for 95% of sales.

Distributor for styrene

McKesson & Robbins Inc., New York, N. Y., has been appointed a national distributor of Monsanto Chemical Co.'s styrene monomer in drum quantities, which is used in the manufacture of polyester resins, surface coating resins, adhesives, ion exchange resins, and as an intermediate in the production of many other chemicals.

The agreement with McKesson & Robbins was made to give Monsanto greater marketing depth through expanded distribution and to provide better service for styrene monomer customers purchasing in less than carload or truckload quantities. The agreement does not affect shipments of styrene monomer to Monsanto's tank car and tank truck customers or to its own polymer producing plants. Such shipments will continue to be made from Monsanto's Plastics Div. styrene monomer plant at Texas City, Texas, and its three distribution points at Addyston, Ohio, New Haven, Conn., and Long Beach, Calif.

Essay contest

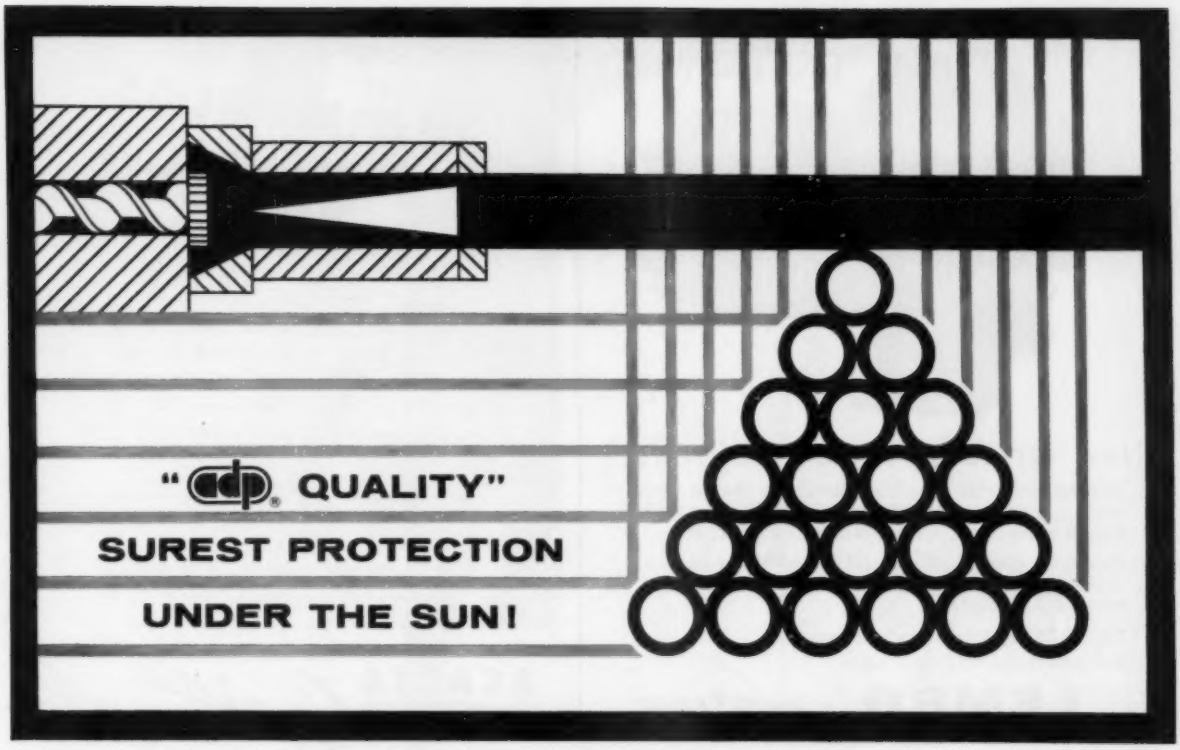
The Society of Plastics Engineers Inc. has made funds available for awards in an essay contest sponsored by the Dept. of Plastics Technology at Lowell Technological Institute.

A first prize of a $50 U. S. savings bond and a second prize, a $25 bond, will be given on May 1 for the best 1000-word essays concerning opportunities in the field of plastics. Essays must be typewritten and submitted with two copies to the department no later than April 1. Upperclassmen enrolled in plastics technology and freshman at the Institute are eligible. Judges will be members of the LTI faculty and officers of the Eastern New England section of the SPE.

Epoxies cost less than glass

Mass production cost of reflective optical components are said to have been reduced to a fraction of former requirements through the use of epoxies.

A case in point is the Repli-Kote mirror, a casting produced on precision ground glass master mirror mold. Both negative and finished product are made of a special epoxy formulation. The reflective surface is an aluminum coating applied in high vacuum and overcoated with a protective film. The epoxy mirror faithfully duplicates intricate configuration, while its essential physical properties are superior **(To page 219)**



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Exposure to sunlight can cause brittleness and eventual failure of plastic pipe not effectively protected with carbon black dispersed throughout the compound. Maximum resistance to this "weathering" depends on the minute particle size of the carbon black, its percentage in the compound and the degree to which it is dispersed in the required resin concentrate. "ADP Quality" black concentrates have established a new standard of excellence in the plastics processing industry . . . wherever uniform and completely dispersed carbon black is required to maintain product quality and long life under extreme conditions of use.

"ADP Quality" carbon black dispersions provide equally protective coloration for wire, filament, and film extrusions. Acheson also supplies ADP concentrates in all standard colors for a wide variety of plastics applications.

Write today for a sample of ADP concentrates in the resin you require . . . or let Acheson specialists work with you to solve your special coloring problems.

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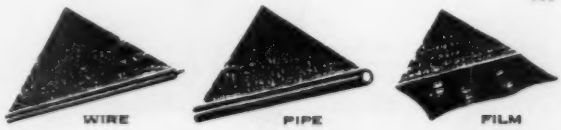

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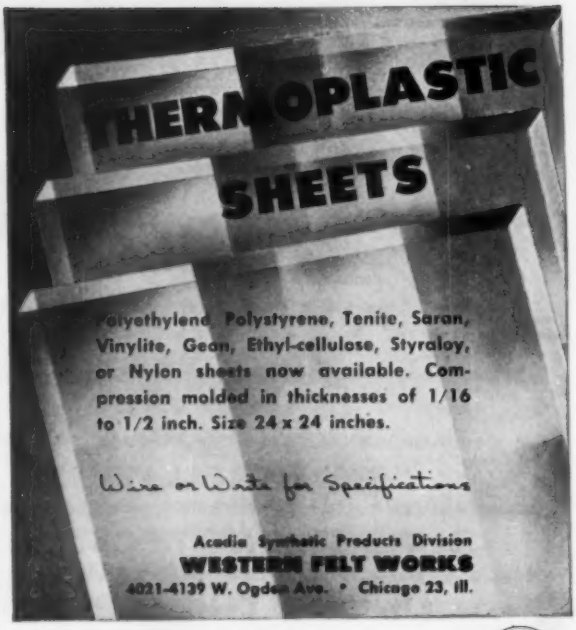
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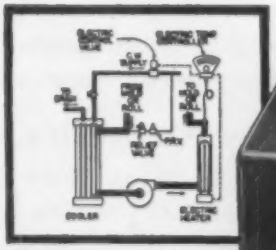

▲ Schematic diagram of control circuit in the Sarcotrol Model MC-1, Single Unit. Model MC-2, Dual Unit, is equipped with two of these circuits. Model MC-3 has three complete circuits.

Sarcotrol Model MC-2 Heating and Cooling Unit for injection molds, cylinders, rolls and drums. Fully enclosed. Easily seen, completely accessible control knobs. ▶

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TEMPERATURE CONTROLS • STEAM TRAPS • STRAINERS • HEATING SPECIALTIES

THE PLASTISCOPE

(From page 216)

to those of glass. Mass manufactured precision 6-in. paraboloid mirrors have withstood as much as 22,000-g. impact.

The Repli-Kote process was developed by HRB Inc., State College, Pa., the research and development division of Singer Military Products Div. Inc., New York, N. Y. The process is said to offer the following advantages: Much higher rate of production than glass reflectors; mounting brackets and other fixtures can be molded into the epoxy backing; electrical and mechanical components can be molded into the backing, offering new potential in optical fields such as infra-red; the bond between the epoxy and the reflective coating is excellent; complex spheric and aspheric surfaces that are not reproducible in glass by mass production methods can now be obtained; resistance to thermal shock and corrosion resistance of the epoxy mirrors is far superior to glass reflectors.

Application potential for Repli-Kote mirrors is said to exist in guidance systems of missiles; photography; surgical and scientific instruments; searchlight reflectors; and other optical uses.

AMA Packaging Conference

The outlook for packaging in the next decade and a review of the status of packaging management will be highlighted at the American Management Association's 29th National Packaging Conference at Convention Hall, Atlantic City, N. J., April 4-6. Theme of the conference sessions will be "Packaging for Profit."

The National Packaging Exposition, which takes place in Atlantic City, N. J. April 4-7, will feature displays by 335 exhibitors covering the latest in packaging machinery, materials, and methods.

Acrylic canopies for aircraft

Three new types of optically refinished transparent acrylic canopies made by Swedlow Inc. have figured in the record-setting performances of the F-106, F-104C, and F-105B aircraft. The canopies for the three **(To page 222)**

Twin Leaders
IN THE METHYL ETHYL
KETONE PEROXIDE FIELD
LUPERSOL® DDM is known for long term stability and uniform catalytic activity. No loss of assay after 1½ years of storage at ambient temperatures. Readily soluble in most synthetic resin monomers. DDM is a convenient, liquid catalyst for the polymerization of polyester and vinyl type resins. Useful in developing "room temperature" cures with polyester resins containing an accelerator such as cobalt.
LUPERSOL® DELTA is noted for producing up to 50% faster gel times on fiberglass lay-up and gel-coat applications. Hard cures and high speed production assured even in cold weather. With autobody putty compounds you enjoy equally rapid gel and sand times with both singly and doubly accelerated putties.
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Chemical Materials Catalog Page 199
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WALLACE & TIERNAN INCORPORATED
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ALSTEELE

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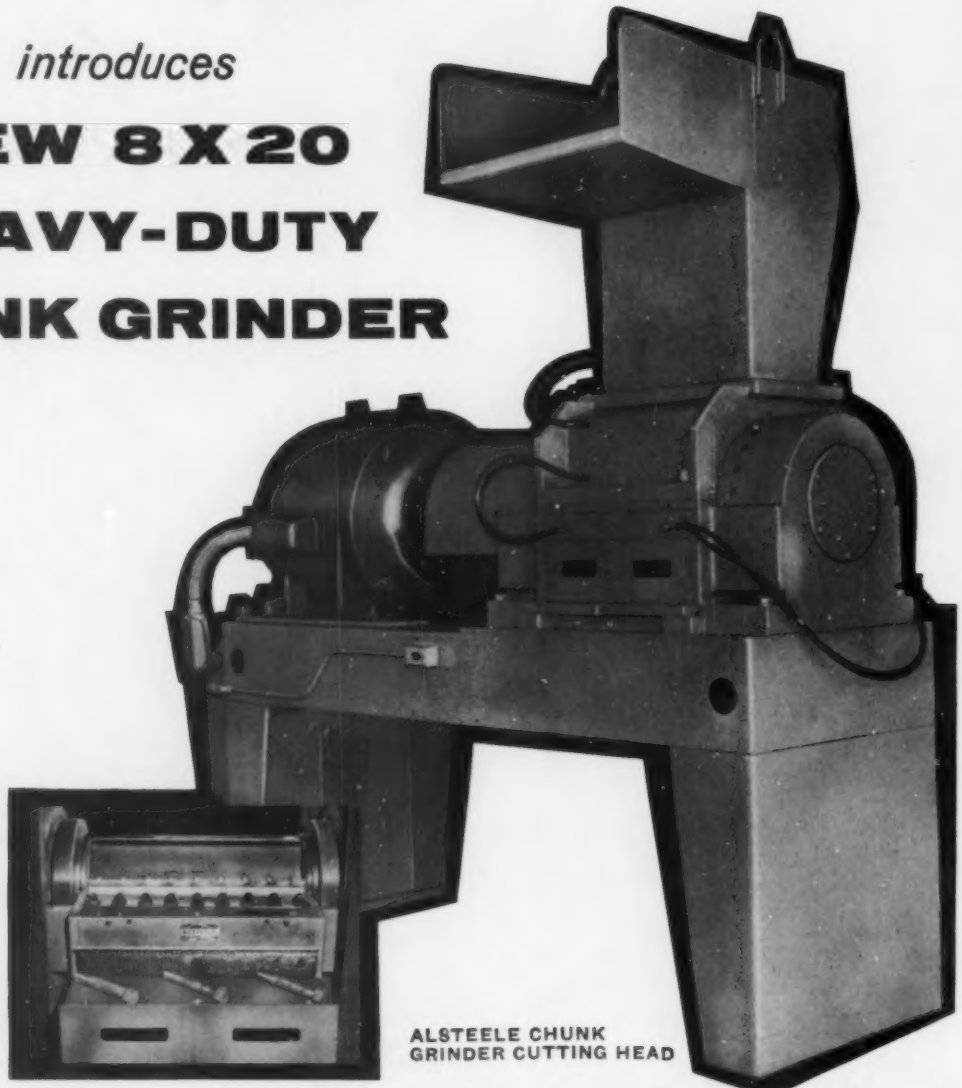
NEW 8 X 20 HEAVY-DUTY CHUNK GRINDER



ALSTEELE CHUNK GRINDER CUTTING HEAD

Alsteele's new 8 x 20, water-cooled, Heavy-Duty Chunk Grinder handles every kind of thermoplastic: thick slabs, bleeder scrap, heavy cross-sectional chunks, and cylinder purgings. This includes scrap of vinyl, polyethylene, Kralastic, high-impact materials, butyrate and synthetic rubbers.

Alsteele *means all steel*: the Chunk Grinder's cutting chambers are *all steel* . . . the hardened forged rotor is machined from *all steel* . . . and the two large, heavy-duty flywheels are *all steel*.

Alsteele's Chunk Grinder is also easy to clean and dismantle, its patented design permitting a screen change in just a few minutes, without disturbing knife clearances.

Alsteele manufactures full lines of beside-the-press, medium and heavy-duty plastics reducing machinery in 1½ to 300 HP models for your every need.

Write or call Alsteele for the name of your nearest representative . . . and for a free, illustrated brochure containing full details.

ALSTEELE ENGINEERING WORKS, INC.

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Manufacturers of the Largest and Most Complete Line of Granulators and Pelletizers.

You can tell a DYLENE® polystyrene handle by the company it keeps

On the most famous brands of portable radios, projectors, sewing machine cases, record players and luggage you will find a good looking, colorful handle of DYLENE polystyrene. Names like General Electric, Philco, RCA Victor, Reliable, Singer, Trojan Luggage Company, Webcor, and Zenith are happy to put a handle of DYLENE in the hands of their customers. The handle shown was molded by Bruce Molded Plastic Products, Inc., Pittsburgh, Pa. DYLENE can withstand strain and impact, has good shock and abrasion resistance, and can be molded in any color with a variety of surface textures. Handles of DYLENE are dimensionally stable and their clean contours make the fitting of handles to hardware a fast, easy procedure. Koppers plastics engineers can help you select from 12 formulations of DYLENE or from other Koppers plastics. For more information, write to Koppers Company, Inc., Plastics Division, Dept. MP-30, Pittsburgh 19, Pa. Offices in principal cities • In Canada: Dominion Anilines and Chemicals Ltd., Toronto, Ontario.

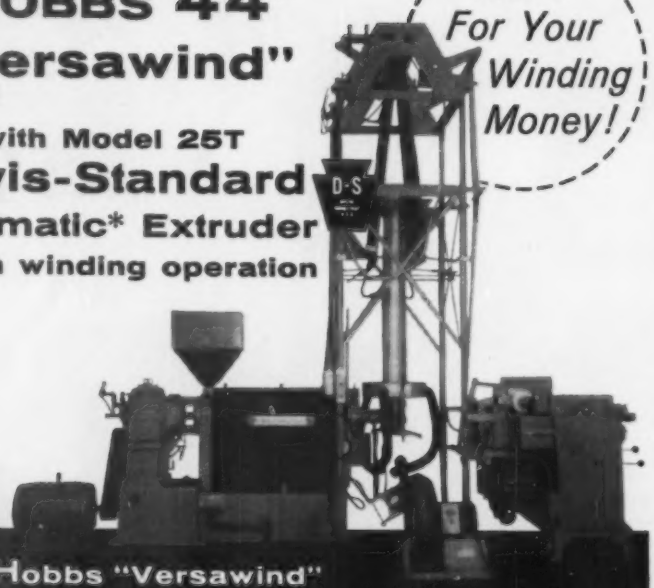
KOPPERS PLASTICS

DYLITE® expandable polystyrene, SUPER DYLAN® polyethylene and DYLAN® polyethylene are other fine plastics produced by Koppers Company, Inc.

HOBBS 44" "Versawind"

with Model 25T
Davis-Standard
Thermatic* Extruder
in film winding operation

More For Your Winding Money!



44" Hobbs "Versawind" at Davis-Standard A CLASSIC EXAMPLE!

Hobbs does give you more for your winding money and here is proof positive!

The 44" Hobbs Versawind shown here is joined to a Thermatic Extruder, Die and Blown Film Tower manufactured by Davis-Standard, a division of Franklin Research Corporation of Mystic, Connecticut. Operating on a 5-day a week basis, the unit tests batches of thermoplastics sent in by extruder customers and runs pilot extruder tests.

Davis-Standard reports

"We selected this Hobbs winder because, in addition to the greater output that it permits, we get more control and range, which are essential for our testing purposes. Every batch of material we run requires a slightly different set-up and the Hobbs Versawind adapts quickly to whatever the tolerance requirement may be."

In fact, Davis-Standard is so confident that Hobbs is the best film winding machine for the money that it offers its famous "Thermatic" Extruder, Die and Blown Film Tower and the Hobbs Versawind as a packaged assembly.

Hobbs builds winding drives and stands from the ground up to best fit your requirements. Hobbs manufactures all types of web winding equipment with all types of winding drives, stands and tension controls (electrical, mechanical, hydraulic, etc.).

*Patented

EST. 1887
HOBBS MANUFACTURING COMPANY

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SLITTERS • AUTOMATIC CUTTERS • DIE PRESSES

THE PLASTISCOPE

(From page 219)

aircraft were treated by a specially designed polishing machine recently developed by Swedlow to improve optical qualities of transparent plastic enclosures.

The Convair F-106 all-weather interceptor, in which Major Joe Rogers recaptured the world speed record, contained an automatic electrical de-fogging enclosure, using highly polished stretched acrylic transparent sheeting. The panel is heated uniformly by means of an electrically conductive coating.

In the Lockheed F-104C Starfighter, which set a new altitude record, the canopy was made of standard acrylic material optically refinished before forming.

The Republic F-105B fighter-bomber record of 1216 m.p.h. has a double glazed stretched acrylic canopy also optically refinished prior to forming.

Anti-static compound

A new material which is claimed to protect permanently plastic phonograph records from developing static and picking up dust is now available from Clarkson Laboratories Inc., Philadelphia, Pa. Called Clarco, the anti-static compound is incorporated into the record mix. Normally, 1 lb. or less of Clarco per 100 lb. of record mix is required.

New Companies

Polyethylene Corp. of America, Cranbury, N. J., is a newly organized film extruder, specializing in PE sheeting for the flexible packaging industry. **Robert N. Green,** pres., is in charge of plant operations and manufacturing. **Paul N. Colby,** vice-president, is sales manager. Both men were formerly with Union Carbide Plastics Co.

General Formulations Inc., a split-off of **General Research & Supply Co.,** Grand Rapids, Mich., has completed a new 11,000-sq.-ft. plant at Sparta, Mich., in which the new company will produce various types of inks, adhesives, and functional coatings for screen process applications. General Re-

search & Supply Co. produces high-speed automatic silk screen printing presses and dryers.

Richard B. Bishop has established a consulting service in petrochemicals and plastics with offices at 13 Prospect Terrace, Leominster, Mass. Services offered include design and plant engineering, research planning and management, etc.

Rogers Associates Inc., Box 752, West Caldwell, N. J., has been formed by **Harry J. Rogers,** formerly with Nopco Chemical Co., to manufacture machinery for the production of urethane foams.

Expansion

W. R. Grace & Co., Cryovac Equipment Div., started construction in Woburn, Mass., on a 50,000-sq.-ft. plant for the manufacture of machinery used in packaging meats, poultry, cheese, fish, and some non-food items in Cryovac bags and film.

Plans call for transfer of facilities and personnel to the new location from the Cambridge, Mass. operation early in June. Most of the 90 employees will transfer with the plant, but additional personnel will be hired to man the expanded operations.

Modern Plastic Machinery Corp., Clifton, N. J. and **Boston Plastic Machinery Inc.,** merged. The Boston company will transfer its operations to Clifton. Integration of the two companies enables MPM to offer a complete blow-molding machine, extruder, and control cabinet. Deliveries will be made from MPM's 80,000-sq.-ft. production facilities. **Leslie J. Kovach,** president of Boston Plastic Machinery, becomes vice-president of MPM in charge of the **Blow Molding Division.**

Hercules Powder Co. and **Imperial Color Chemical & Paper Corp.** have agreed in principle to the acquisition of the business and assets of Imperial in exchange for Hercules stock.

Imperial is a supplier of pigments to the plastics, paint, varnish, and synthetic **(To page 227)**

DAVIS-STANDARD

2½" thermatic* with HOBBS 44" "Versawind"

More For Your Extrusion Money!

Complete D-S Blown-Film Package with Hobb's Wind-up

THE TOP PRODUCTION TEAM

- Model 25T thermatic Extruder
- Precision Rotative Crosshead Die
- High Capacity Air Ring and Blower
- Adjustable Tower
- Versatile, High-Speed 44" Winder by HOBBS MANUFACTURING COMPANY, Salisbury Street, Worcester, Mass.

"Package" pays-off in Profit

In order to get the most for your money in a blown film line, each component must be a top performer. That's why Davis-Standard recommends and sells Hobbs winding equipment as part of the complete blown film "package". The production capacity of the rugged Model 25T thermatic Extruder is unequalled by any competitive machine.

Our precision Rotative Crosshead Die is a natural outgrowth of recognized D-S superiority in crosshead technique for the exacting requirements of the wire industry for many years.

This "Package" of Davis-Standard and Hobbs machinery offers the blown film producer a complete set-up with performance and versatility to meet any tolerance requirements . . . and all from a single supplier!

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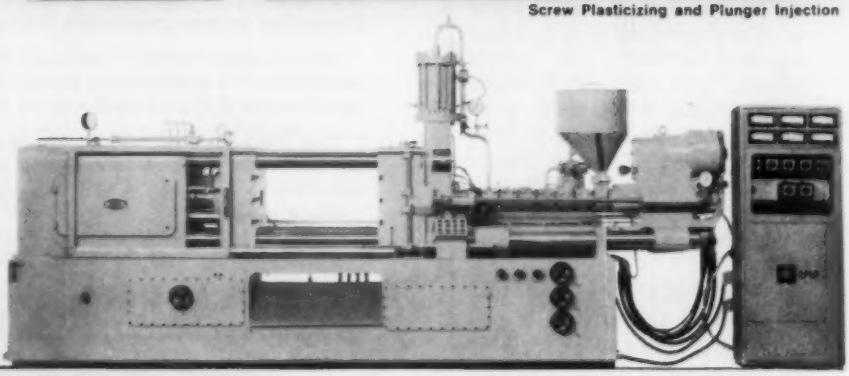

Machine Factory and Foundry Ltd. Netstal/Switzerland

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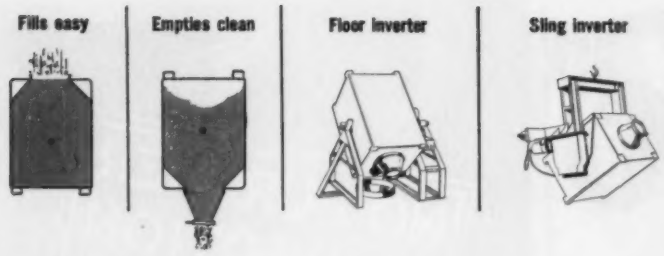

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MOUNT VERNON, NEW YORK

THE PLASTISCOPE

(From page 223)

fiber industries, among other activities. The company, with its principal office in Glens Falls, N. Y., has plants located in Glens Falls and Plattsburg, N. Y., and a wholly-owned subsidiary in St. John's, Quebec, Canada.

For the calendar year 1959, Imperial expects to have a total sales of about $27,127,000. In the same period, Hercules sales are expected to aggregate approximately $280 million.

Milprint Inc., Milwaukee, Wis., producers of flexible packaging materials, is expanding and consolidating manufacturing operations on the East and West coasts.

Additional facilities are being constructed at the Downingtown, Pa. plant, which will absorb the company's present separate plant at Christiana, Pa.

On the West coast, ground was recently broken for an addition to Milprint's plant in South San Francisco, Calif. When completed around June 1, 1960, the new San Francisco facility will absorb all the manufacturing formerly done at the company's Los Angeles, Calif. plant.

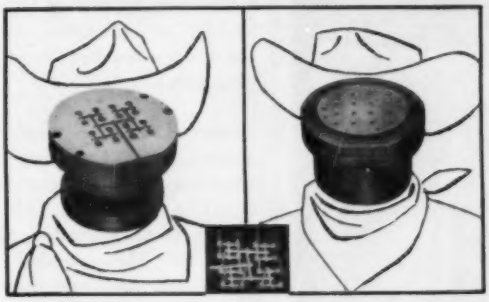
Filon Plastics Corp. has opened its new $2 million plant in Hawthorne, Calif. for the manufacture of fibrous glass reinforced plastics building panels. It features four continuous production lines capable of almost tripling the annual capacity of the company's former manufacturing facilities in El Segundo, Calif. In addition, the new production lines are said to operate 30% faster than the company's previous equipment.

Filon can now produce panels up to 60 in. wide, instead of the maximum 48-in. width previously produced by the company.

Allied Chemical Corp. has selected Orange, Texas as the site for its new high-density polyethylene plant. Completion is expected late this year. The additional PE facility at Orange will form the first unit of a supplement to existing polyethylene production at Tonawanda, N. Y. Output at the latter **(To page 228)**

WANTED

TOUGH ASSIGNMENTS



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Dept. MPL-1, Bethel, Vermont.

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Here it is! **BUMB-LUBE**, the remarkable mold release that amazes even experts who said it couldn't be done! **GIVES YOU TWICE AS MUCH AS ANY OTHER RELEASE, AT ANY PRICE.** It's an exclusive formula with **PLUS X** that prevents sticking, eliminates residues, reduces flow friction. Non-toxic, non-explosive, non-inflammable. 20 Oz. can provides hundreds of applications, less than 1¢ each. Send now for your **FREE** 20 OZ. SAMPLE . . . they said it couldn't be done . . . but we've done it, and how!

$2.50 single can, 12 to 47 cans, ea. **$1.90.** 48 or more cans **$1.75** ea. F.O.B. plant.

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350A Sunrise Highway
Rockville Centre, N. Y.
Send me FREE 20 OZ. SAMPLE OF BOMB-LUBE.

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City_____ Zone___ State___

THE PLASTISCOPE

(From page 227)

location was increased 25% last year, and will be further increased during 1960.

The new PE unit at Orange will adjoin an ethylene derivative plant operated by the company's Nitrogen Div.

Chemcell Ltd. a wholly-owned subsidiary of **Celanese Corp. of America,** plans to acquire an interest in **Polybottle Ltd.,** of Toronto, Ont., Canada, manufacturer of blow-molded plastics containers, toys, and other items.

Canadian Chemical Co., a subsidiary of the Chemcell firm, is a supplier of plastics, including high-density polyethylene, to the molding and packaging industries.

The Richardson Co., Melrose Park, Ill. producer of industrial plastics products and laminated sheets, has acquired for cash a majority interest in **Plastics Corp. of America,** Stamford, Conn. Plastics Corp., which was previously a subsidiary of **Lincoln Plastics Corp.,** recently entered the polystyrene field, and erected a plant for the production of styrene copolymers, graft polymers, and other specially modified styrene materials.

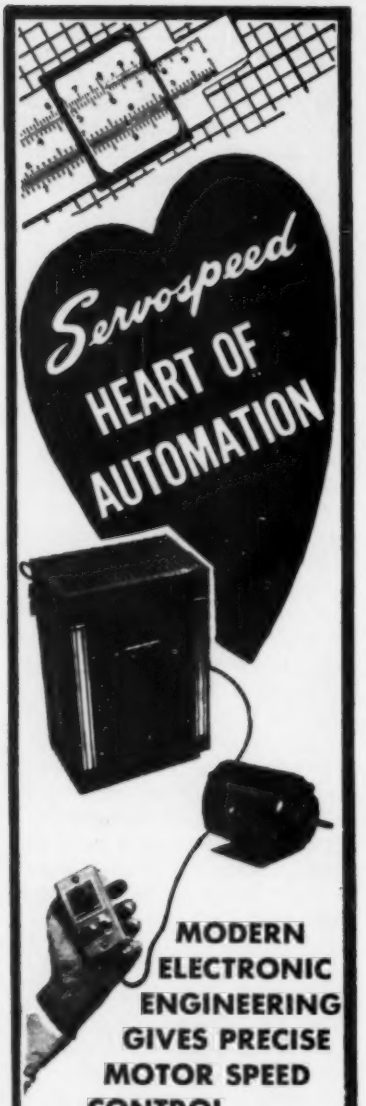
Carl J. Luster, who is also president of Lincoln Plastics, will remain president of Plastics Corp. of America, and **Richard G. Brown** remains vice-president.

Young Machinery Co. Inc., Pennsdale, Pa., acquired the plant and manufacturing facilities of **Robinson Mfg. Co.,** Muncy, Pa. Both companies manufacture materials-handling, pneumatic conveying, and mixing systems for use in the plastics, chemical, and other industries.

Young Machinery Sales Co. Inc. will continue to act as exclusive sales agent for both facilities.

Sun Chemical Corp. has purchased the **Facile Corp.,** Paterson, N. J., in a cash transaction.

Facile produces special laminated materials for atomic energy installations, high altitude experimentation and atomic submarines, as well as a **(To page 230)**



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Modern industrial electronic engineering has been coordinated with electric motor design to provide a versatile means for obtaining the full possible advantage of speed control in DC motors while operated from the regular alternating current power line. Grid controlled "Thyratron" tubes are utilized for power controlled stepless variation to supply motor armature power. Patented feedback, or "Servo" circuits provide constant torque capability over wide speed ranges of as high as 60 to 1 in some models and a minimum of 20 to 1 in others.

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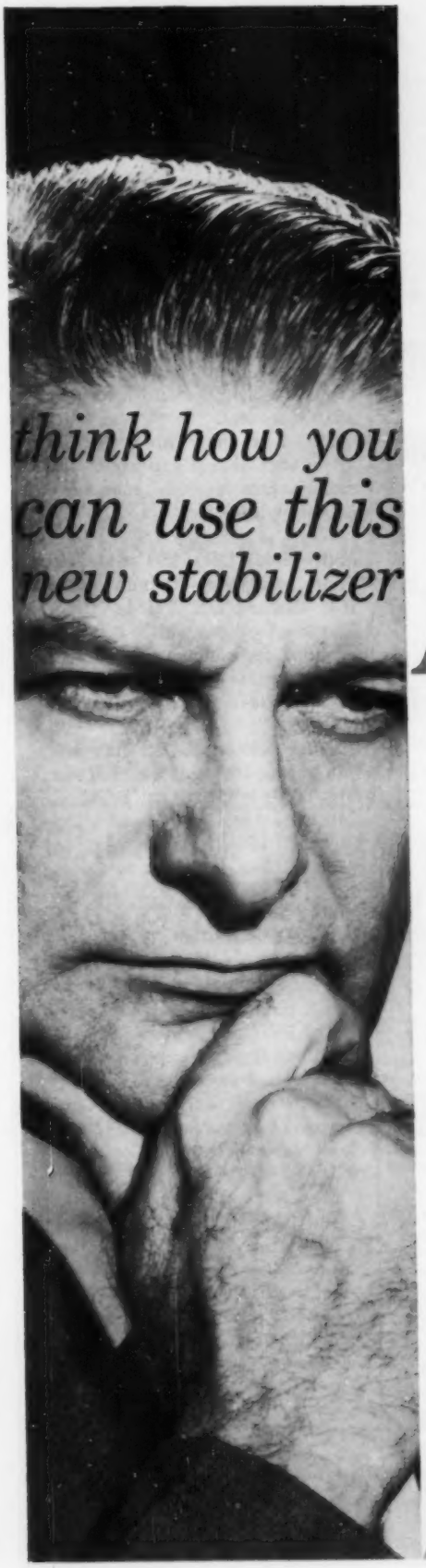

rigid vinyl heat distortion temperature 8° to 12° higher with new Advastab T-360

If you've been stymied in vinyl improvement because of inability to get extra heat stability, either in processing or in the finished product, try **new Advastab T-360** . . . with heat stability at least twice that of any other stabilizer.

This unique stabilizer, an organo-tin in crystalline form, gives you unexcelled heat and light stability in one package . . . enables you to do things with vinyl heretofore impossible due to inadequate heat and light stability.

Now, **for the first time,** your product is stabilizer odor-free—retains original resin heat distortion, which is 8° to 12° higher —has uncompromised formulation for: optical clarity, proper lubrication control, atmospheric staining control and plate-out processing.

For convincing evidence of the effectiveness of **new Advastab T-360,** send for sample and data sheet. Our Technical Service Department will be glad to give you the benefit of their experience. Write today!

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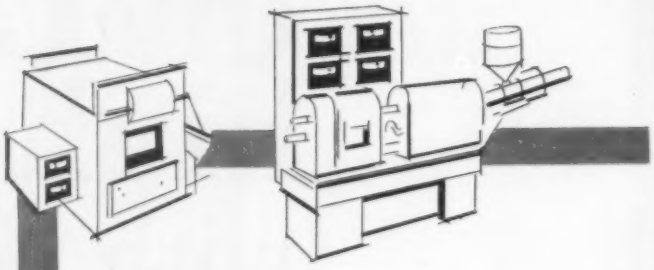

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"Our equipment sells best on performance, including ease of operation and maintenance. We can't risk dissatisfaction that stems from components, such as instruments. We're safer with Gardsman, by West, and their world-wide service."

Users say

"Instrumentation can be the key to overall efficiency of major equipment. West temperature controllers work better than most, definitely save on several counts . . . including initial cost. It pays to specify."

Whatever type of control—off-on, proportioning, high-limit, stepless, program—get the best: get West. *Tubeless.* Compact. Reliable. Ask your West representative or write for Bulletin COM.

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the trend is to WEST

THE PLASTISCOPE

(From page 228)

basic line of coated and laminated films and fabrics and industrial and decorative tapes.

Eugene Jacobson, former president, will continue to manage the Facile division as part of Sun's Chemicals Group.

Dawbarn Brothers Inc., Waynesboro, Va., producers of olefin yarns, has added 50,000 sq. ft. to the company's previous expansion of its original plant, for a total of 160,000 sq. feet.

The new plant area will be given over almost entirely to the manufacture of the company's polypropylenes.

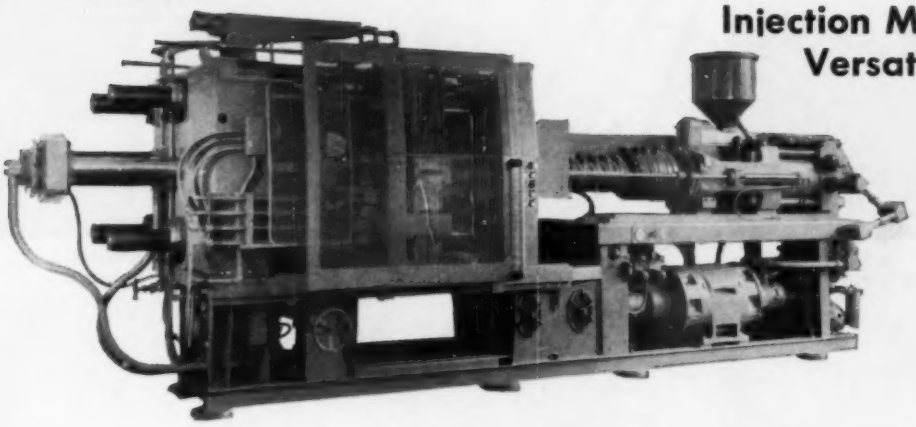
Multi-Meter Corp. has moved to a new 15,000-sq.-ft. building at 1635 Coining Dr., Toledo, Ohio. The new facilities will be used for handling the company's bulk liquid dispensing equipment, including the Flo-Rite drum faucet.

Stauffer Chemical Co. has acquired the **Plastic Pipe & Tube Div., Anesite Co.,** Santa Barbara, Calif. The Anesite pipe production facilities have been moved to Vernon, Calif. and are now operating as a unit of **Stauffer's Molded Products Div.** In addition to the Anesite line, Stauffer is planning to produce and sell customer and proprietary brand extruded products as well as a new line of PVC pipe and tubing.

William Hess, president of Anesite, will act as technical advisor to Stauffer and will also direct his company's activities as a West Coast sales agent for Stauffer's extruded products.

The Molded Products Div. executives who will be responsible for the development of the Anesite line are: **Ralph Rector,** director of sales; **William McPherson,** production manager; **John M. Colgan,** director of development; and **Charles Lindsay,** vice-president and manager.

Rieke Metal Products Corp., Auburn, Ind., manufacturers of plastics closures, will erect a one-story office and warehouse on land recently acquired at Industrial Lane and **(To page 234)**



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Model HA16–425 — **720 Dry Cycles Per Hour**

200 Pounds Per Hour Plasticizing Capacity

24½ Inch Stroke — **Hydraulic Knockout**

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- Operates unattended, stops automatically
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- Complete repeatability with unskilled personnel
- Uses small sample, has simple rugged constant temperature bath
- Uses standard test tubes & replaceable Pyrex stirring rods
- Amortizes itself quickly
- Your best investment for QUALITY CONTROL

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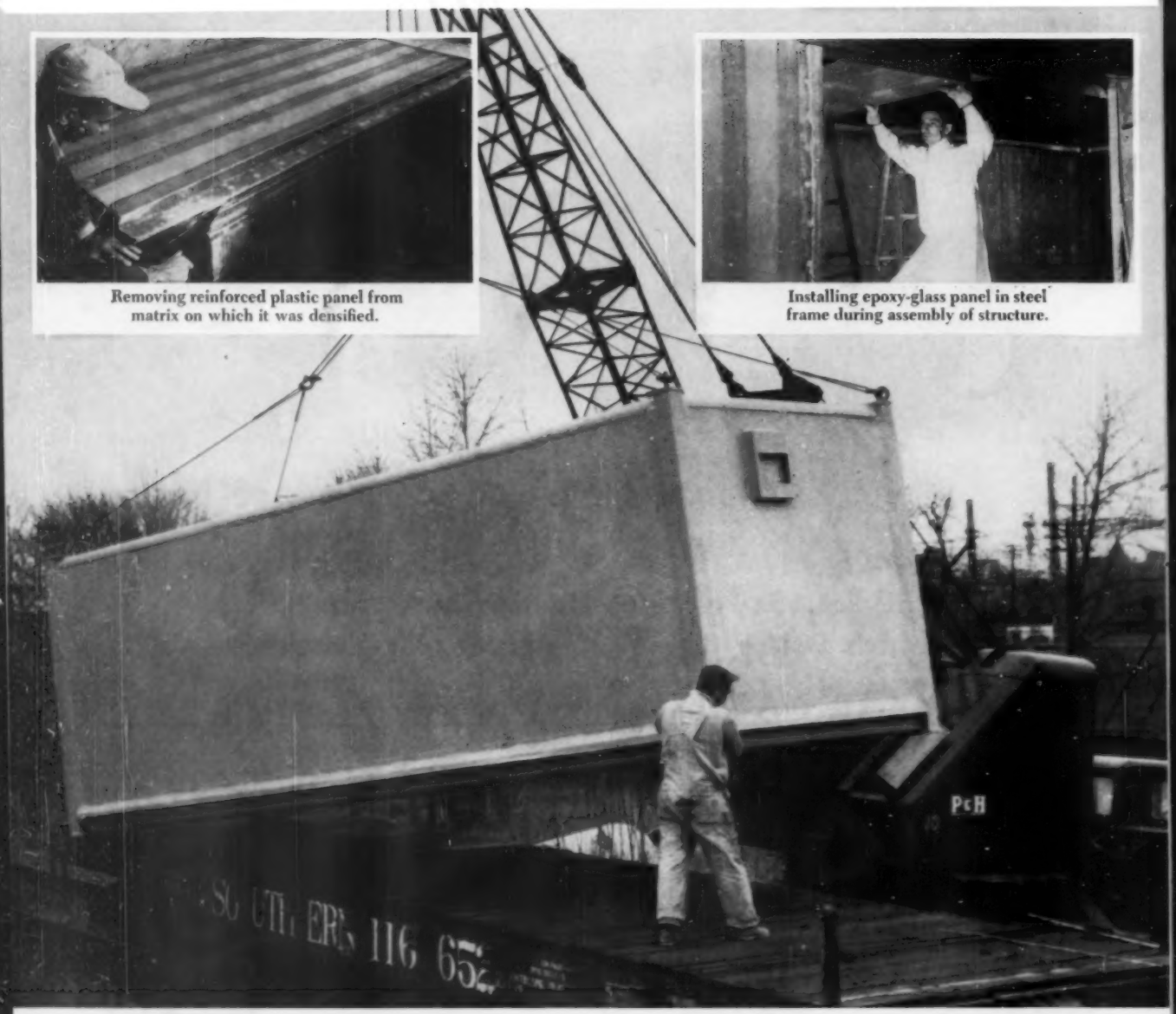
Used By Hundreds Of Leading Plants

Removing reinforced plastic panel from matrix on which it was densified.

Installing epoxy-glass panel in steel frame during assembly of structure.



GIANT REINFORCED EPOXY CONTAINER

Holds up to 40,000 lbs., Stacks Five High Loaded!

This twenty-four foot by eight foot shipping container is the latest development in reinforced plastics. Constructed of 4′ x 8′ epoxy-fiber glass panels fastened to a steel frame, it combines outstanding strength with light weight. It offers wide possibilities for bulk shipment by rail, truck or ship . . . and can be stacked five high, fully loaded.

The container was developed at Union Carbide Development Laboratories using BAKELITE Brand Epoxy resins. Panels were fabricated with a new spray gun that blends the epoxy resins and hardener automatically. Each panel has an epoxy-glass core built up on corrugated cardboard and sandwiched between two epoxy-glass sheets each one-tenth of an inch thick.

Severe tests showed a floor deflection of only three-tenths of an inch, after being loaded with 40,000 pounds of water. Use tests are now underway.

For information on the construction and testing, write Dept. CC-01L, Union Carbide Plastics Company, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, N. Y. *In Canada:* Union Carbide Canada, Ltd., Toronto 7.

UNION CARBIDE

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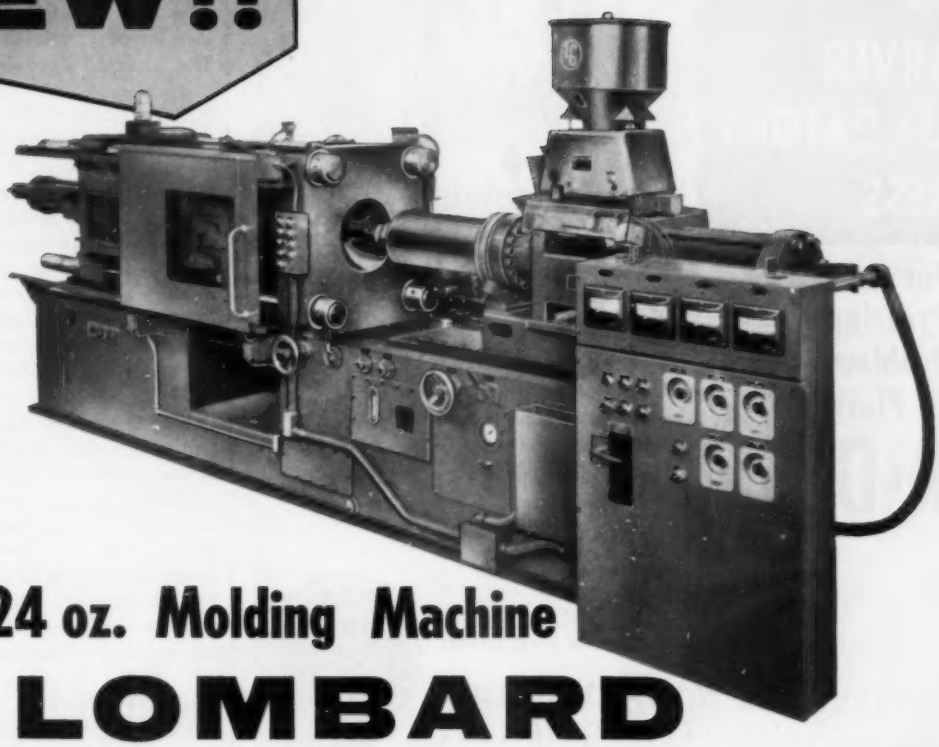
NEW!!



18/24 oz. Molding Machine

by LOMBARD

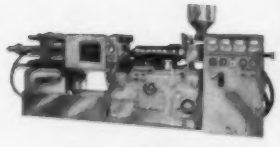
FASTER THAN MOST 12/16 oz. MACHINES

HAS ALL THESE *"MODERN-AS-TOMORROW"* FEATURES

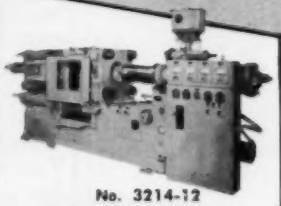
- Big, rugged, fast
- 50" daylight opening
- Plunger speeds over 400 in./min.
- 24" clamping stroke — 450 ton clamping pressure
- Injection rate over 1400 cu. in. per min.

REMEMBER! There's a **LOMBARD** for all your molding requirements that incorporates refinements beyond the expectations of today's or even tomorrow's demand.

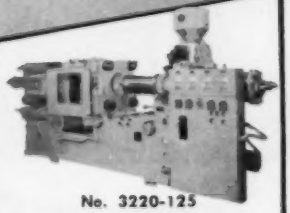
SEND FOR COMPLETE CATALOG



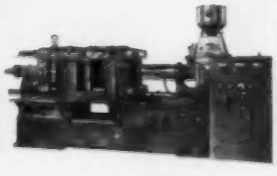
No. 2414-6
- 6/9 oz.
- 32" daylight opening
- Max. die size 14⅞" x 28"



No. 3214-12
- 12/16 oz. economy model
- 36" daylight opening
- Max. die size 20" x 36"



No. 3220-125
- 12/16 oz. high speed model
- 42" daylight opening
- Max. die size 20" x 36"



No. 3220-16
- 16/20 oz. model
- 42" daylight opening
- Max. die size 20" x 36"

Injection Molding Machine Division

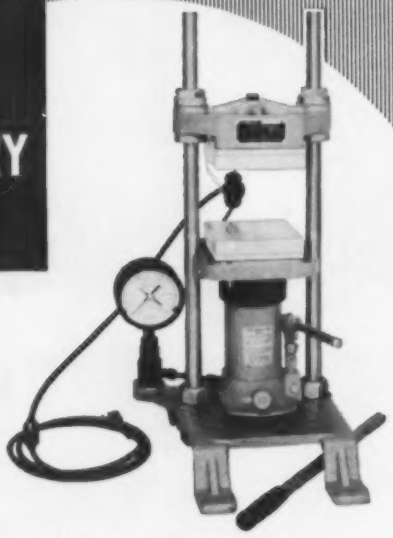
LOMBARD GOVERNOR CORPORATION

Ashland, Massachusetts

The
CARVER LABORATORY PRESS

for Your Pressing Problems in Plastics

R&D



The Carver Laboratory Press is standard equipment for research and development. Provides accurately controlled pressures to 24,000 lbs. Carver Standard Accessories include Electric or Steam Hot Plates, Carver Test Cylinders, Swivel Bearing Plates, Cage Equipment. Promptly available from stock. Write for latest bulletin.

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HYDRAULIC EQUIPMENT
3 CHATHAM ROAD, SUMMIT, N. J.

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Not a New Issue

February 17, 1960

71,090 Shares

U. S. Polymeric Chemicals, Inc.

Common Stock

(Par Value 50¢ Per Share)

Price $40 Per Share

Copies of the Prospectus may be obtained in any State in which this announcement is circulated from only such of the underwriters, including the undersigned, as may legally offer these securities in compliance with the securities laws of such State.

DOMINICK & DOMINICK

14 Wall St., N. Y. 5, N. Y.

THE PLASTISCOPE

(From page 230)

Commerce Road, Linden, N. J. The project, scheduled for completion early this spring, is the initial Eastern warehouse operation for the company.

Scientific-Atlanta Inc., Atlanta, Ga., electronics manufacturer, acquired all the outstanding capital stock of **Polyco Inc.,** Smyrna, Ga., manufacturers and distributors of plastics swimming pool and marine items, with current annual sales of about $120,000. Scientific-Atlanta plans for expansion of Polyco to produce plastics missile and electronic components formerly produced by a division of Scientific-Atlanta. In addition, a substantial cash investment is being made by **Turpentine & Rosin Factors Inc.,** Jacksonville, Fla., to provide capital for expansion into new lines of commercial and military plastics.

Gagliardi Research Corp. has started construction on a new laboratory building and is enlarging laboratory facilities at the present location in East Greenwich, R. I. The 200% increase in floor area will provide space for additional research personnel who have specialized experience in plastics.

Midland-Ross Corp., Waldron-Hartig Division, has started work on a new and enlarged extrusion laboratory at Mountainside, N. J. The company has also installed a Hartig 2½-in. extruder, with coating and sheeting die, in the **Waldron Web Processing Laboratory** at New Brunswick, N. J., to demonstrate extrusion coatings, laminating, and cast film processing. The laboratories are provided as a service to make trial runs on new products, and provide samples for market testing.

Mount Hope Machinery Co., Taunton, Mass., manufacturers of free wheeling expanders and other equipment used in the manufacturing and processing of plastics, has started construction on a new plant on Ross Drive, Charlotte, N. C. The new plant will have facilities for servicing of all the company's **(To page 237)**

Finest Quality **PLASTIC MARKING**

right in your own shop...with high precision Kingsley Machines—Hand or Air Operated.

Send a sample or description of parts to be marked for complete details, or write for free literature.

1000 stampings or more per hour

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NEW!

No More Sprues

Internally Heated Bushing and Nozzles*

Hot Tip Nozzles can be used in place of conventional sprue bushings—gate directly into parts or runner system. No external heaters required. Allows small gates and permits prolonged interruption of cycle without freeze-ups.

Makes Better Molded Parts—by producing fast, precise temperature control for conventional and impact molding.

Cuts Costs—by eliminating sprue cutting, grinding and scrap losses. Saves by shortening start-up time, preventing drooling nozzles.

Write for complete data and convenient Quotation Request Form.

* Patent Pending

Injection Control Corporation

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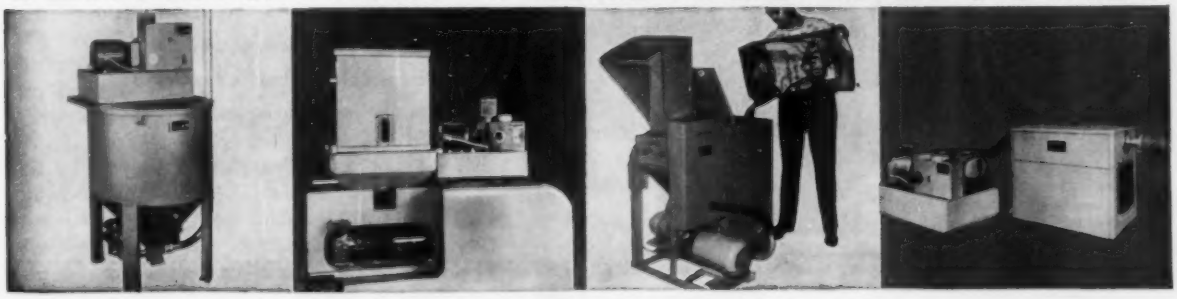
THORESON-McCOSH, INC.

SERVING THE PLASTICS INDUSTRY



1 Hopper-dryer and Jet hopper loader

More production, lower costs, higher products quality because of properly controlled conditioning of material, no compressed air. Easy installation in minutes.

2 Thoreson-McCosh Hopper-dryer

Dries and preheats material at less cost than conventional drying ovens. Easy installation on standard injection and extrusion machines. No compressed air.

3 Shearway granulator, blender and loader

Granulates and loads in one operation. With our Hopper-dryer it is the most effective drying, loading, granulating, blending unit obtainable. No compressed air.

4 Thoreson-McCosh new Hi-dri unit

Simple mechanical (no chemicals) dehumidifier for use with our Hopper-Dryers on extremely hygroscopic materials under high humidity conditions, inexpensive.

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An automatic multi-spindle Rotary Finisher that performs ALL these operations:

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- GRINDS

Accommodates circular moldings up to 4½" in diameter, 8" in height. Continuous and intermittent operation.

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ROTARY EDGER No. 116

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93 Worth Street • New York 13, N. Y.

THE PLASTISCOPE

(From page 234)

products and will house the Southern sales office, under the direction of **Slaughter Machinery Co.**, Charlotte.

Federal Pacific Electric Co. added a 35,000-sq.-ft. plastics processing plant to its 750,000-sq.-ft. manufacturing complex at Newark, N. J. The new facility will compound, preform, mold, and machine finish plastics components for the company's lines of circuit breakers, switches, fusible service equipment, instruments and metal-clad switch-gear.

Plant capacity is 500,000 lb. of molding compound per month. At full capacity, the new plastics processing operation will employ approximately 200 persons.

Western Backing Corp. has started construction of a 42,000-sq.-ft. new home office and processing plant in Westminster, Calif. An additional 4000 sq. ft. will be used for research, development, and executive offices, and a further 200 sq. ft. will house the chemical mixing and blending facilities.

The company is engaged in processing resins and reinforced plastics. Now located in Culver City, Calif., Western Backing expects to occupy the new plant by midsummer, employing approximately 150 persons.

Sealomatic Electronics Corp. has acquired a 25,000-sq.-ft. structure at Scott Ave. and Randolph St., Brooklyn, N. Y., where the company's electronic heat sealing equipment production will be consolidated.

Chase Bag Co. has established production facilities for converting polyethylene film to bags at the company's New Orleans, La. plant. PE bags of all types and sizes are now produced at the New Orleans plant. Any printed bag can be produced at the new facility, including tube, side weld, back seam, and draw cords. Bags are printed in as many as six color combinations.

The New Orleans converting installation has substantially increased Chase's PE capacity. Other Chase polyethylene plants are in Los Angeles and St. Louis, where the company's film extrusion facilities are located.

Olympic Plastics Co. Inc., Los Angeles, Calif., has started construction of a 40,000-ft. addition to its plant to house blow molding facilities. The company reports that blow molded tanks, floats, and toys, as well as bottles have found rapidly increasing markets.

Norman H. Spear, formerly director of plastics research for Continental Can Co., Paper & Plastic Container Div., Chicago, Ill., has been appointed general manager of Olympic's blow molding department.

Meetings

Plastics groups

March 21: Society of Plastics Engineers (S.P.E.) Newark Section, Extrusion Professional Activities Committee, Prof. Bryce Maxwell, "Extrusion without screw or ram." Auditorium, Esso Research & Engineering, Linden Ave., Linden, N. J.

April 7, 8: Society of the Plastics Industry Inc. (S.P.I.) 17th Annual Western Section Conference, New Riviera Hotel, Palm Springs, Calif.

April 20: S.P.E. North Texas Section, "Plastics in the Petroleum & Chemical Industries," Hotel Texas, Fort Worth, Texas.

April 20, 21: S.P.I. Cellular Plastics Div. Automotive Conference, Statler Hotel, Detroit, Mich.

April 20-22: S.P.I. 3rd Annual Fluorocarbons Div. meeting, Hotel Roosevelt, New Orleans, La.

April 25, 26: S.P.I. 18th Annual Canadian Section Conference, London Hotel, London, Ont., Can.

May 20, 21: Norwegian Plastics Federation (Norsk Plastforening), International Plastics Exhibition and Convention, Oslo, Norway.

Other groups

April 5-7: Building Research Institute, Spring Conference, Technical programs on paints, adhesives, and plastics information workshop, Statler-Hilton Hotel, New York, N. Y.—**End**

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You are *sure* of proper cure characteristics when you use a Bradley-Vrooman plastisol. As a pioneer plastisol supplier, Bradley-Vrooman has a wide range of specially tailored formulations for molding, dipping, spraying and casting. We have also available for your use the combined services and experience of a complete experimental laboratory. *Write today for details, mentioning your application.*

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2

Two-Color Blowing

In One Operation

KAUTEX

Features

Two-In-One

Blowing

Automat

With this outstanding new KAUTEX Two-In-One Blowing Automat, it has become possible to blow articles made of polyethylene of two (or more) different colors or of high and low density in one single operation automatically. The line of the seam may be straight (see toy-boat) or of any pattern (see toy-automobile). In any case, the seam is clean and well fixed. It certainly does not take great imagination to see the many possibilities buried in this revolutionary new process.

Write now for thorough information! It pays to ask KAUTEX when your problems and your ideas are dealing with plastics.

KAUTEX will help you gladly.

Manufacturers of blowing equipment for articles up to 5 x 2 1/2 x 2 feet.

KAUTEX is the leader in the plastics blowing field

KAUTEX-WERKE

KAUTEX-WERKE
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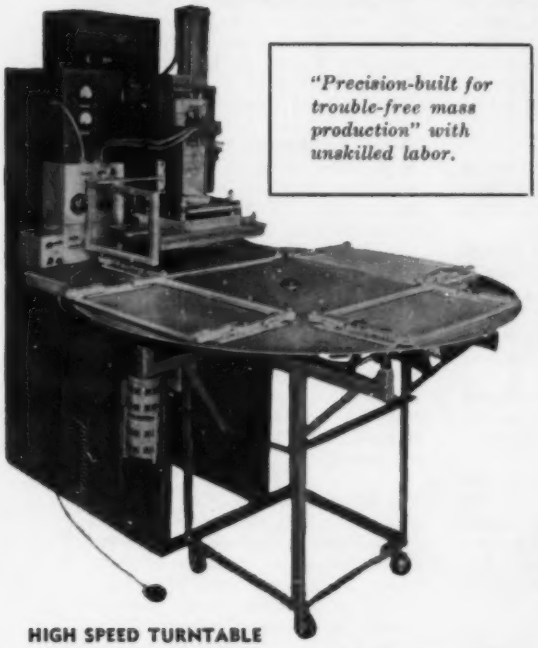
K

COSMOS... PROGRESS in HEATSEALING



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"Precision-built for trouble-free mass production" with unskilled labor.

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- Extensive, exclusive basic improvements which have been granted U.S.A. and Foreign Patents!
- More than 90% of the COSMOS Heatsealers now in daily use, have been sold to manufacturers who previously used other brands!

Distributors from coast-to-coast and world-wide—for distributor closest to you—WRITE or CALL TODAY for full details and sealing samples:

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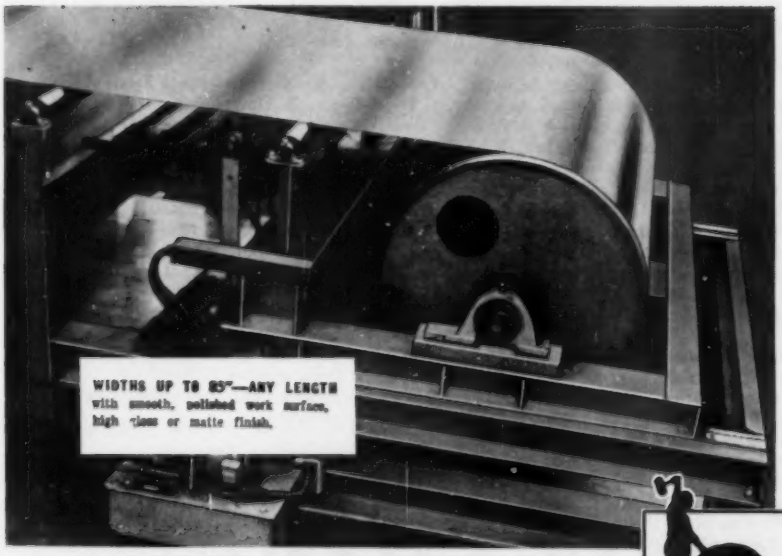
Endless Stainless Steel Belt does COMPLETE processing job in ONE continuous operation

Heating • hot fusing • cooling • drying • setting • curing • surface finishing



If you produce sheets, film, coated products, laminates, flooring, foam rubber, latex or other flat work of plastic or rubber, investigate continuous belt processing with "Metalsmiths" endless stainless steel belts. Learn how leading processors are speeding production—cutting costs—improving product quality.

"Metalsmiths" (18-8) stainless steel belts are engineered to your needs. Precision-made, high tensile strength and springlike qualities, edges hand-filed and rounded, camber held to a minimum, working surfaces polished to a smooth finish that imparts an automatic contact gloss.

Consult our engineers on the possibilities for your products, without obligation.

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Specialists on Stainless Steel Fabrication.

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ENDLESS CONVEYOR BELTS

COMPANIES...PEOPLE

Appointments, promotions, and relocations in the plastics industry.

Hooker Chemical Corp., Durez Plastics Div.: George A. Shroyer named mgr. of the newly-established dist. sales office at 333 W. First St., Dayton, Ohio, which serves the Mich.-Ohio dist. The Detroit, Mich. office continues as a branch office, and the sales office at the Kenton, Ohio plant has been discontinued.

The combined Los Angeles, Calif. sales office of the Durez Plastics and Western Chemical divs. is now located at 6277 E. Slauson Ave.

Celanese Corp. of America—Celanese Plastics Co.: Howard S. Malby appointed head of field tech. svc. and **William P. Mastrolia** named dir.—market research.

Celanese Development Co.: William M. Shine appointed VP.

The B. F. Goodrich Co.: Edward R. Bartley named to newly-created post of mgr.—marketing research.

The Chicago, Ill. sales office for flooring, carpet cushions, industrial cellular matls., Koroseal vinyl upholstery, and wall covering moved from 4646 W. Lake St. to Space 13-115 of the Merchandise Mart.

Continental-Diamond Fibre Corp.: Dr. W. M. Lair named dir. R&D, and **A. H. Haroldson** appointed asst. dir.

Howard J. Coffey named dist. sales mgr. Philadelphia, Pa., and **Harold M. Dexter Jr.** appointed as sales rep. in Philadelphia.

Taylor Fibre Co. formed a Molded Parts Dept. Previously the company produced molded parts as a service of its Fabricated Parts Dept.

Richard L. Smith named dist. mgr. of the Rochester, N. Y. sales office.

Dr. Fred P. Baughman joined as a group leader in the Tech. Dept.

Monsanto Chemical Co., Plastics Div.: Newly hired personnel at Springfield, Mass. include **Robert J. Stevens, Thomas J. Stolki,** and **Jacques Tocatlian** in the research dept.; **Paul Rajendra** in the engineering dept., and **Michael J. Roman** in the sales dept.

American Cyanamid Co.—Plastics & Resins Div.: The executive offices, including the div.'s sales, mfg., merchandising and advtg., tech., purchasing and acctg. depts., will move from New York, N. Y. to Wallingford, Conn. about August 1, 1960.

Formica Corp.: Robert W. Fromme named prod. mgr., Industrial Products, succeeding **Harry Gruenwald,** who retired.

Albert L. Munsell named to head the sales training dept. **John Stockhausen** appointed Baltimore, Md. dist. mgr., succeeding **Charles H. Kronenberg,** who will sell the company's industrial products. **Ray Carson** named dist. mgr. in Nashville, Tenn., succeeding **James H. Curran,** who will also handle sales of industrial products.

Allied Chemical Corp.—Plastics & Coal Chemicals Div.: Frank M. Norton has been promoted from VP to exec. VP.

Theodore R. Von Toerne named asst. supv.; and **Herman de Haan** is mechanical engineer, resin applications research at Edgewater, N. J.

William S. Burriack appointed chemical sales rep. for the Buffalo-Pittsburgh area.

National Aniline Div.: Dr. Harry H. Weinstock Jr. appointed to the newly-created position of Co-ordinator, Polyamide R&D.

Solvay Process Div.: Wilbur H. Brumfield promoted from exec. VP to pres. of the div. **John B. Green** named asst. to the pres., and **Robert H. Reed** is dir. of development.

General Chemical Div.: Frank J. French promoted from exec. VP to div. pres.

Extrudo-Film Corp., Long Island City, N. Y.: **I. E. Becker** named tech. service mgr. in charge of the newly-created Field Research Div. His immediate projects are research into the development of PE film for overwrap and automatic packaging machine applications; and new uses for PE film.

Alfred Slatin has joined the company as Eastern sales mgr.

Rank Audio Plastics moved its exec. and sales offices from 24 W. 57th St. to 25 W. 56th St., New York, N. Y. The company is a joint operation of **The Rank Organization,** London, England, and **Librarie Hachette,** Paris, France, and produces thin, high fidelity plastics records for premium and sales promotion use.

Matthew B. J. Quinn appointed dir. of sales.

Oronite Chemical Co., San Francisco, Calif., a subsidiary of **Standard Oil Co. of California,** created a Coating & Plastics Chemical Div. to sell Isophthalic, phenol, acetone, and phthalic anhydride. **H. B. Pollock,** formerly Midwestern sales mgr., moves from Chicago, Ill. to the home office to head the new div.

Leonard J. Stone named area sales supv. of the div. for eleven Western states.

Mitchell Plastics Inc., Pittsburgh, Pa.: **Lois D. Mitchell** named pres. and chrmn.; **David L. Mitchell Jr.,** VP and gen. mgr.; **David L. Mitchell Sr.,** secy.-treas.; and **Robert D. Mitchell,** prod. mgr. The company, formerly known as **L. D. Mitchell Plastic Studios,** is a custom fabricator in industrial parts.

Metal & Thermit Corp., Rahway, N. J., mfrs. of vinyl stabilizers and organotin catalysts: **Donald W. Oakley** named a VP. He will retain his assignment as gen. mgr.—Coatings Div. **Harry W. Buchanan** appointed a VP in addition to his post as mgr. —gen. sales dept.

Aerojet-General Corp., Azusa, Calif., a subsidiary of **The General Tire & Rubber Co.,** combined the Structural Plastics Div. and the Materials Dept. into the **Structural Materials Div. Edward L. Rucks** appointed mgr. of the new div.

The Baker Castor Oil Co., Bayonne, N. J.: **Joseph L. Montague** joined as a development engineer and **Dorian Doptoglon** as a research chemist. Castor polyols are used as components in urethane foams and as modifying agents in urethane prepolymers.

General Aniline & Film Corp. has moved its home office from 230 Park Ave. to the Time & Life Bldg., 111 W. 50th St., New York, N.Y.

Cadillac Plastic & Chemical Co. opened branch and warehouse facilities at 2505 E. Washington, Indianapolis, Ind.

Wallace & Tiernan Inc., Lucidol Div.: Dr. J. B. Harrison named dir. —R&D. He will also direct the newly-created Commercial Chemical Development Dept. **R. M. Berry** has been appointed mgr. of the dept.

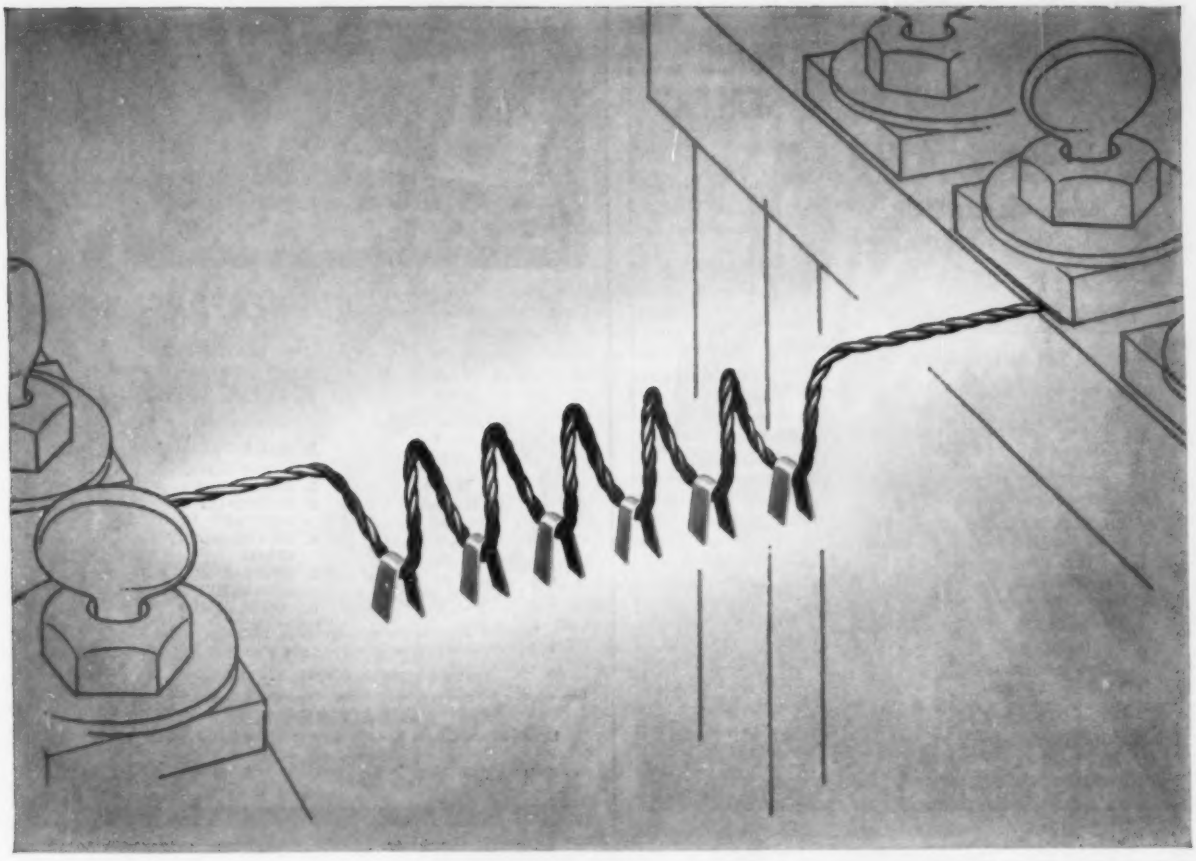
W. R. Pellom named asst. sales mgr. **D. C. Noller** appointed supv.—Tech. Service Laboratory, and **S. W. Bukata** named supv.—Analytical & Control Laboratory.

Dr. David B. Guthrie joined as asst. chief chemist, R&D; and **E. J. Wandel** becomes a chemist in the Process Development Laboratory.

The Lucidol Div. manufactures organic peroxides.

Du Pont, Film Dept.: Robert C. Myers appointed dir.—Packaging Sales Div., and **Henry C. Broems Jr.** named dir.—Industrial Sales Div.

Hostachem Corp., North Hollywood, Calif., will take over from **Westco Chemicals Inc.** the sales and distribution in the western United States of the products of **Farbwerke Hoechst, A.G.,** **(To page 243)**



New *high-performance tungsten strand makes better vacuum metallizing coils*

Vacuum metallizers who wind their own coils will benefit from the controlled re-crystallization rate built into Sylvania's new metallizing strand. Not only will coils be easier to produce, but they will have a much greater shot life. Controlled re-crystallization reduces brittleness and twisting, minimizing premature breakage during reloading and processing.

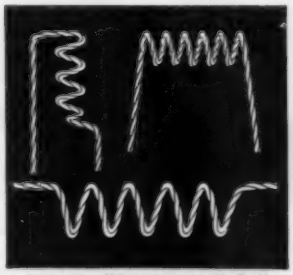
This new Sylvania wire has been thoroughly service-tested in many types of coils. Its uniformity and freedom from splits are assured by electronic quality-control testing during production.

Your Sylvania Field Sales Engineer will be glad to supply you with complete details. Call him now.

These sizes now in production:

No. of strands		Wire Size Inches	No. of strands		Wire Size Inches
2	x	0.030	3	x	0.040
3	x	0.020	4	x	0.015
3	x	0.025	4	x	0.020
3	x	0.030	4	x	0.030
3	x	0.030	(with 0.025" aluminum core)		

Write for new technical bulletin



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Whether you require tubings, rods, bindings, weltings, or special shapes, it will pay you to consult Vogt.

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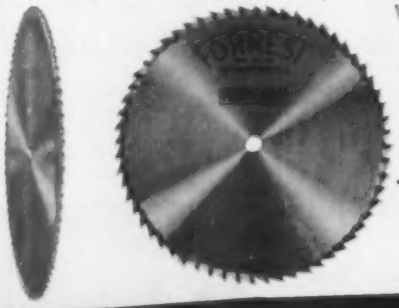

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INSERTED TOOTH FOR:
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Forrest engineers an individual blade for each specific cutting problem with exclusive features not found in other blades. Forrest eliminates vibration, chipping, burning and gives smoother edges for perfect jointing.

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SUPERIOR COATINGS BORN OF CREATIVE PLASTIC CHEMISTRY

For the protection or decoration of plastics, and the production of metallized objects, there's a REZ-N-LAC coating by Schwartz.

Perfected through twenty years of pioneering research devoted exclusively to the plastics industry, REZ-N-LAC coatings never peel, flake or craze—are non-toxic and specifically formulated for each individual application.

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SPECIFY THE REZ-N-LAC FOR YOUR PARTICULAR NEED

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REZ-N-LAC	V for Vinyls
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REZ-N-LAC	M for Methacrylate
REZ-N-LAC	BC-107 Base Coat for Styrene Metallizing
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MANUFACTURERS OF DYES—LACQUERS—CLEANERS—ADHESIVES— FOR PLASTICS

COMPANIES...PEOPLE

(*From page 240*)

and its subsidiaries: **Knapsack-Griesheim A.G., Kalle & Co. A.G.,** and **Behringwerke A.G.**

J. J. Lent is pres. of Hostachem. Westco will remain at 6850 Tujunga Ave., and its personnel will serve through Hostachem.

Gits Molding Corp., Roselle, Ill., was reorganized and two new corporations formed with an even division of prior assets. One corporation is **J. P. Gits Molding Corp.** and the other **J. A. Gits Plastics Corp.,** custom injection molders, with **Gitsware Corp.** as its proprietary subsidiary.

Nopco Chemical Co., Newark, N. J.: **George G. Stier,** formerly VP—Plastics Div., N. Arlington, N. J., elected pres. He succeeds **Ralph Wechsler,** who is now chrmn. of the board of directors.

Harry A. Batley promoted from VP.—Industrial Production to exec. VP. **G. Daniel Davis,** former exec. VP, becomes v.-chrmn. of the board and continues as pres. of **Jacques Wolf & Co.,** a Nopco subsidiary.

The Plastics Div. of Nopco manufactures urethane foam and urethane prepolymers.

General Latex & Chemical Corp., Cambridge, Mass.: **William H. Jefferson** has been promoted from asst. to the pres. to VP and gen. sales mgr.

H. G. Brousseau appointed tech. sales mgr., compounds & dispersions; **R. V. Does** is tech. sales mgr., natural & synthetic latices; and **J. B. Blomstrom** has been named tech. sales mgr., urethane foams.

The company has recently entered the plastics field with a line of urethane foams, coatings, and adhesives.

Spencer Chemical Co., Plastics Div.: Robert F. Flaherty named resin sales rep. for Conn., and **Richard Paulsen** for Wis. and Minn.

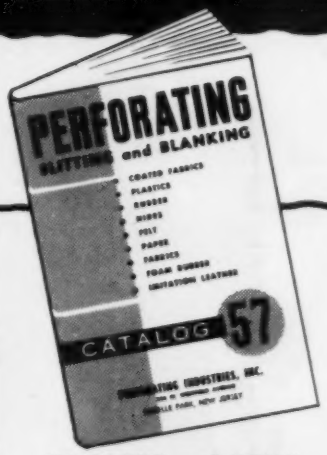
Emery Industries Inc., Cincinnati, Ohio: **L. Paul Dougherty** and **Jack Doyle** have joined the Organic Chemical sales staff, which handles azelaic acid, dimer and trimer acids, pelargonic acid, plasticizers, lubricant and fatty esters.

Radiant Color Co., Oakland, Calif.: **Brad Clark** named national sales mgr. **Edward J. Franz** named Chicago, Ill. office mgr. **Robert E. Wagner** now heads the New York, N. Y. office, and **Herbert D. Haworth Jr.** appointed West Coast salesman. The company manufactures fluorescent coated products and pigments.

Vinyl Fabrics Institute: Jules D. Lippmann, gen. mgr., **Textileather Div., General Tire & Rubber Co.,** re-elected pres. Also **(To page 246)**

NEW 16 page Catalog

TO HELP SOLVE YOUR DESIGN PROBLEMS



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Independent motorised two-speed nip adjustment—manual or automatic.

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Drilled rolls for use with H.P.W. system for accurate temperature control.

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7 outstanding features

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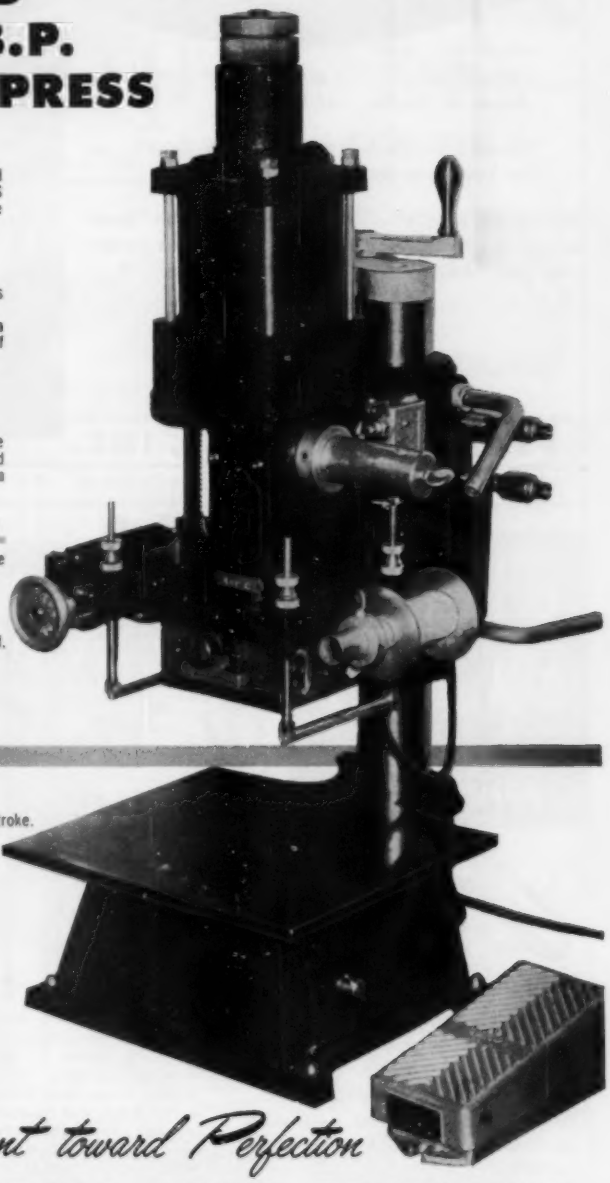

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for hot stamping on cloth, paper, leather, wood, fibre, soft and hard plastics, hard rubber and most other materials. PEERLESS ROLL LEAF available in gold, imitation gold, aluminum, a wide range of pigment and metallic colors.

★ **AIR OPERATED**

Press has a built in air cylinder which is cushioned at both ends of cylinder to avoid hammer blows on work.
In addition to raising and lowering screw we have included a micrometer adjustment at top of cylinder for adjustment of impression.
Press is equipped with a timing relay for dwell control.

★ **FOOT OR HAND CONTROL**

Foot control, standard equipment, leaves operator's hands free to position articles to be stamped. Also available with hand control. Speed adjustment permits up to 40 impressions a minute, depending on articles and materials being stamped.

★ **AUTOMATIC HEAT CONTROL**

Electrical outlet built into press. Pilot light, thermometer, insure uniform temperature.

★ **AUTOMATIC ROLL FEED**

Adjustable, feeds up to 5" of leaf 4¼" wide. Side to side feed.

★ **BUILT FOR PUNISHMENT**

by Peerless, pioneers in roll leaf stamping.

SPECIFICATIONS

SIZE:
15" wide x 19" deep x 36" high. Depth of throat opening 6" from center of heat. 5" maximum opening from die plate to table. 2" stroke.

STATIONARY TABLE:
12" x 11"

AIR PRESSURE:
Not less than 2 h.p. compressor — 80 lb. pressure equipped with 60 gallon tank. Compressor not supplied.
Pressure approximately 19 times line pressure.

ELECTRICAL:
110 volts A.C., unless otherwise specified.

SHIPPING WEIGHT:
220 lbs. Net, 270 lbs. Gross
Head size: 4" x 5"
Die plate size: 4" x 5"
Chase size, inside: 3" x 4"

EQUIPMENT INCLUDES:
lubricator, regulator, strainer and 6 ft. of hose.

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Prompt Service . . .
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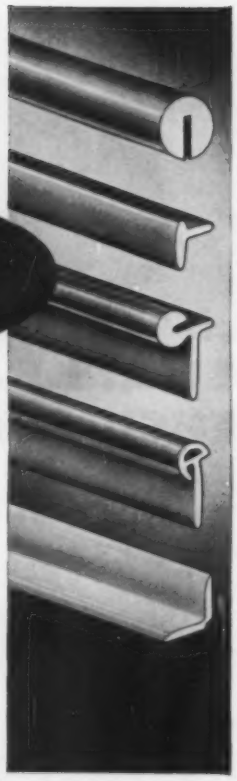
On Long Or Short Runs

PYRAMID
VINYL EXTRUSIONS



Pyramid excels in the production of special shapes in Vinylite and Geon.

Shown here are a few of the many shapes we have recently produced.

Our Custom service includes plastic coating on "hard-to-coat" materials and fabrication of complete assemblies from SARAN plastic pipe, tubing or rods.

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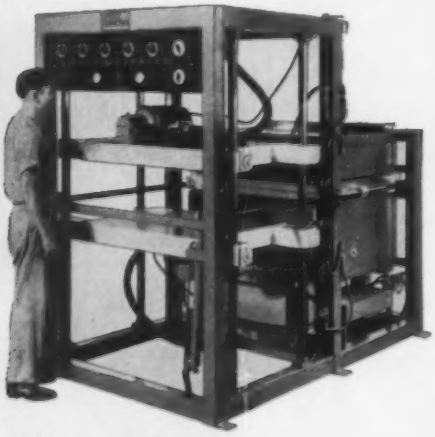
UNLIMITED APPLICATIONS



Comet STAR
THERMO-PLASTIC FORMING MACHINE

GREATER ECONOMY made possible by reducing plastic blank size, control of uniform material distribution and reduction of internal stress of fabricated parts.

UNLIMITED APPLICATIONS made possible through new techniques designed into the STAR.

Two counteracting platens, electrically driven and independently controlled, makes it possible to perform all known forming techniques on this machine—Straight Drape and Vacuum Forming, Inverted Drape and Vacuum Reverse, Billow Forming, Air Cushion Forming, Pressure Forming and Ring and Punch Forming. Write for bulletin M3.

Other Standard Comet Machines: Lab Master; Vacuum Forming and Packaging Machine and the Comet Material Slitter. Three Station Rotary; Mercury Continuous Automatic Skin-Pak and Slitting Unit; and

Comet INDUSTRIES / FRANKLIN PARK, ILLINOIS, U.S.A. Progress in Plastics

COMPANIES...PEOPLE

(From page 243)

re-elected were **C. Gordon Jelliffe, Columbus Coated Fabrics Corp.**, Columbus, Ohio, 1st VP; and **Paul Howard, Weymouth Art Leather Co.**, South Braintree, Mass., 2nd VP. **Paul F. Johnson** remains exec. secy.

Colton Chemical Co., a div. of **Air Reduction Co. Inc.**: **John V. Kaine** named Central District sales mgr. with headquarters in Cleveland, Ohio. **Charles P. Albus** joined the polymer research group.

Union Carbide Corp., Union Carbide Plastics Co.: The following were appointed tech. sales reps.: **Donald T. Smith** in Boston, Mass.; **Paul B. Hanrahan** in St. Louis, Mo.; **W. Keith Atkins** in Chicago, Ill.; and **Benedict Letizia** in Cincinnati, Ohio.

The Texas dist. sales office has been moved from 1511 Bryan St. to 6300 North Central Expressway, Dallas, Texas.

Witco Chemical Co. Inc., Organic Chemicals Div., New York, N. Y.: **Harold B. Seligman** named VP & gen. mgr.; **Jerome Harrison** now VP & dir. of marketing; **Stanley D. Shaw** appointed Midwestern sales mgr. The division manufactures vinyl stabilizers, plasticizers, polyesters, and phthalic anhydrides.

Hysol Corp. is the new name of **Houghton Laboratories**, Olean, N. Y., suppliers of epoxy adhesives and insulation products.

Thermo Electric Co. Inc., Saddle Brook, N. J., manufacturers of temperature measuring systems and allied equipment, moved its Midwest sales offices to 5780 N. Elston Ave., Chicago 46, Ill. **Clint White** heads the office. He is assisted by **James Fabrie.**

Foster Grant Co. Inc.: **Charles C. Brewer**, formerly tech. asst. to the plant mgr., promoted to asst. plant mgr. at Baton Rouge, La. **Charles V. Sleeth** named sales mgr. of the Chemical Div.

The appointments are part of a program to establish the Louisiana operation as a separate chemical div. The Baton Rouge plant is said to have a styrene monomer capacity in excess of 110 million lb. a year.

Sealzit Co. of America, 3640 Chicago Ave., Riverside, Calif., has cancelled previous distribution plans for its spray guns and accessory equipment used in RP molding, is now selling direct.

The Carwin Co., North Haven, Conn., absorbed its subsidiary, **Carwin Polymer Products Co. Inc.**, and its business will be conducted by The Carwin **(To page 251)**

NEW NAME-STIK

BRILLIANT FOIL PRESSURE SENSITIVE NAMEPLATES PRODUCED ON METAL

—for use on metal, ceramics, plastics, glass, wood—in fact on almost every smooth surface.

Low Cost Solution to your Nameplate Problem

NAME-STIKS are as attractive in appearance as metal nameplates, and their pressure-sensitive backing makes them so much simpler and faster to apply.

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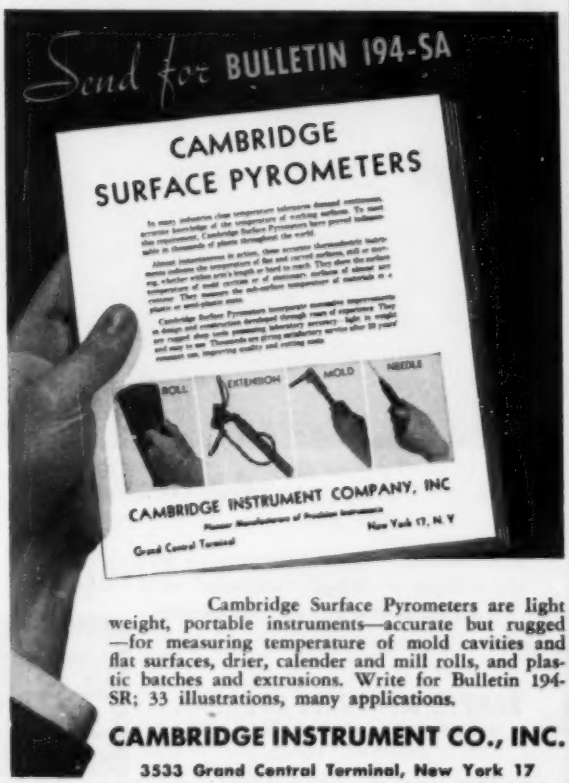

Cambridge Surface Pyrometers are light weight, portable instruments—accurate but rugged —for measuring temperature of mold cavities and flat surfaces, drier, calender and mill rolls, and plastic batches and extrusions. Write for Bulletin 194-SR; 33 illustrations, many applications.

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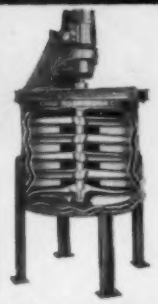
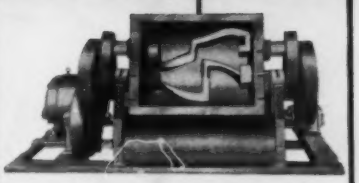
PLASTIC PROCESSING MACHINERY

gives better results in less time!

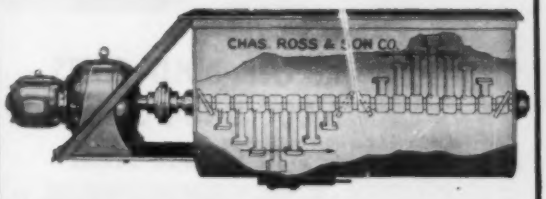


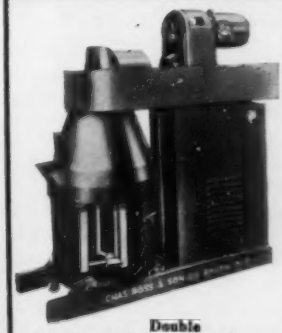
Vertical Mixers
100 - 1000 Gal. sizes



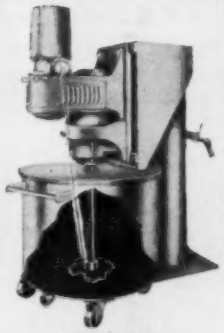
Heavy Duty Double Arm Kneaders
1 pint - 150 Gal. sizes

Horizontal Mixers
100 - 1000 Gal. sizes





Double
Planetary Change Can Mixers
1 - 150 Gal. sizes



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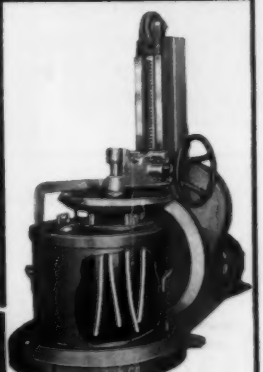
Change Tank Mixers
80 - 250 Gal. sizes

Also Dry Crushing and Pulverizing Mills, Three Roller Mills, Hopper Mills, High Speed Dissolvers or Dispersers, and Mixers of all types for Dry, Liquid, Paste and Heavy Paste Materials.

Write for complete information!



Heavy Duty
Change Can Mixers
5 - 60 Gal. sizes

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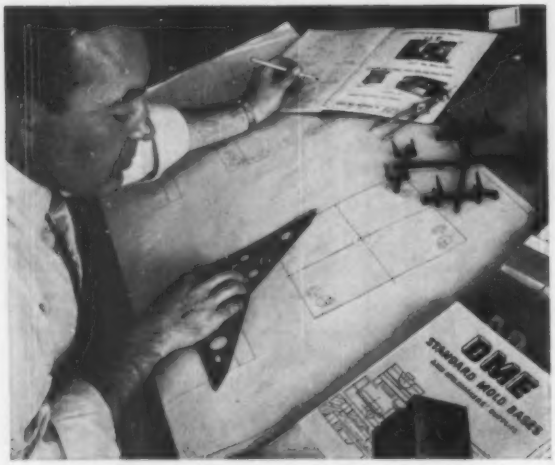

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Whether it's a one-cavity "test" mold or a 60-cavity high production run, chances are D-M-E has the right size Standard Mold Base to fit the job and the molding machine.

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Start saving on your next moldmaking program, no matter how large or small. Take advantage of D-M-E Quality, Service and Economy.

Faster deliveries from complete stocks
Over 1,000 D-M-E Standard Mold Bases always IN STOCK at local D-M-E Branches for IMMEDIATE DELIVERY.

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- D-M-E CORP., CLEVELAND: 502 Brookpark Rd.—DAYTON: 558 Leo St.
- D-M-E of CANADA, Inc., TORONTO, ONT.: 156 Norseman Ave.

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SAVES TIME . . . SAVES MONEY

The pneumatic Aero-Shaft holds any core firmly providing uniform tension that allows faster roll speeds.

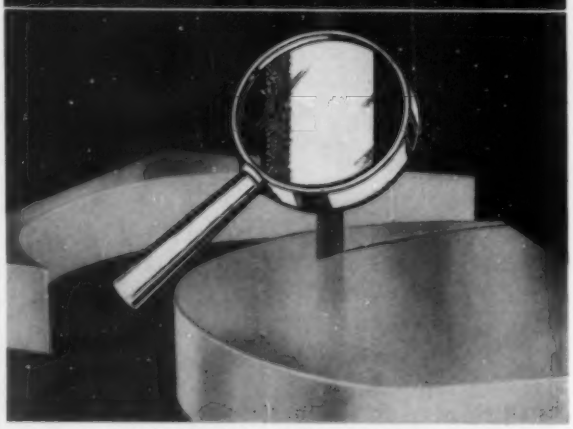
Aero-Shaft eliminates core damage . . . deflates instantly for split-second removal from used to new core.

Double expanding rib section available for web widths over 40". Write today. Start saving with Aero-Shaft!

Folders, Rewinders, Embossers, Napkin and Core Machines, Letterpress and Flexographic Presses, Special Converting Machinery

PAPER CONVERTING MACHINE COMPANY
GREEN BAY, WISCONSIN

DIAMOND COATED BAND SAW BLADES

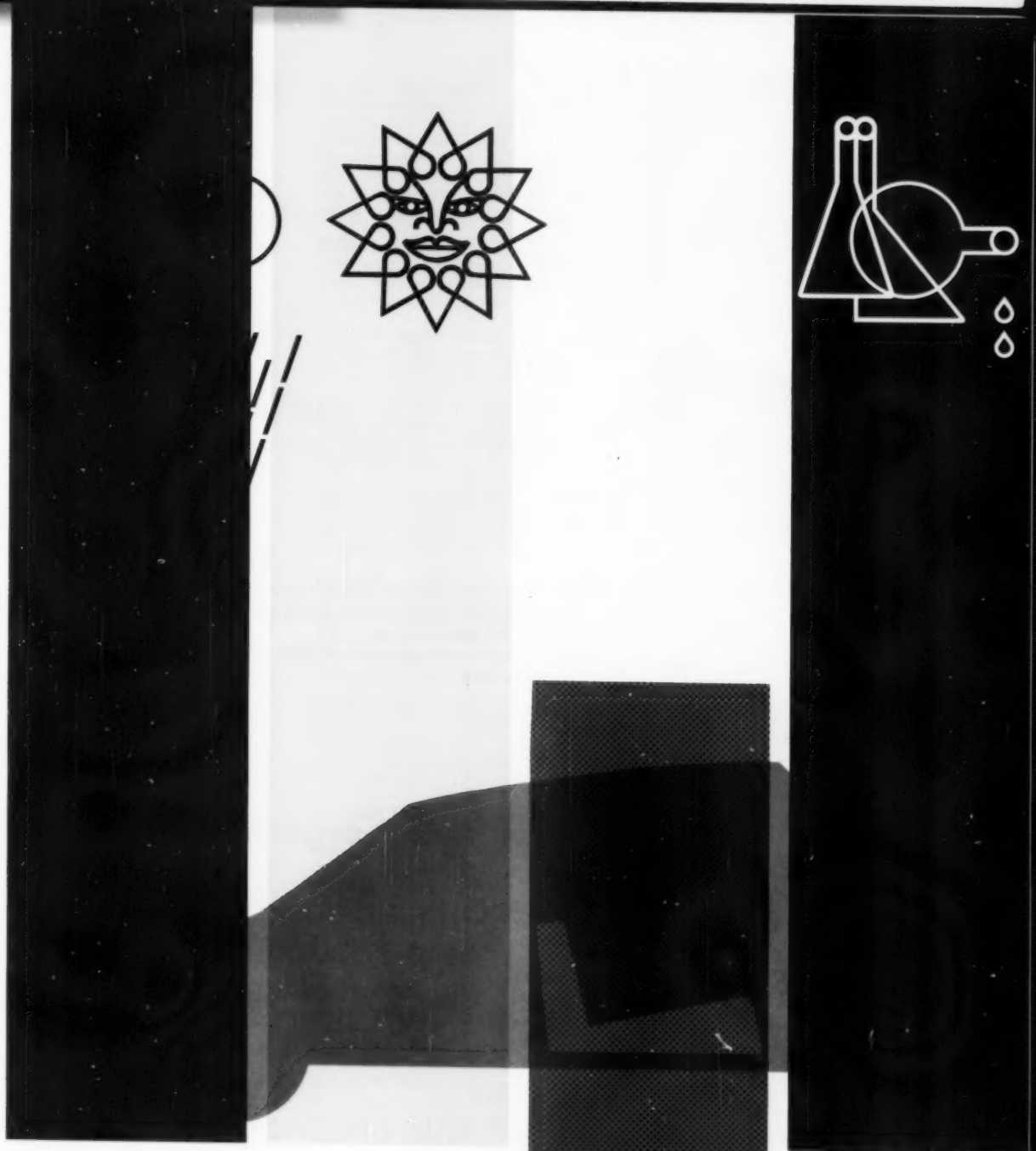


For cut-off of reinforced plastics, ceramics, carbides and glass. Ideal for wafering of large diameter Germanium and Silicon Solar Discs.

NOW AVAILABLE — diamond saws especially designed for cut-off and machining of reinforced plastics.

Precision cut-off wheels for semi-conductor production — made in Thicknesses down to .004".

SAMPLE MARSHALL LAB., INC.
MANUFACTURERS OF QUALITY DIAMOND TOOLS
63 PARK AVENUE, LYNDHURST, N. J. WEbster 3-0570



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CIBA, for decades in the forefront of technical development and high-quality production in the field of dyes, pharmaceuticals and plastics, now also

produces organic pigments for the plastics and organic coating industries.

Colors for plastics and organic coatings

C I B A

(*From page 246*)

Co., Polymer Products Div., whose personnel remains unchanged. Carwin produces PAPI, a specialty isocyanate used in the manufacture of urethane products.

Mitchell Specialty Div., Industrial Enterprises Inc., Philadelphia, Pa.: **Alan J. Breslau,** formerly with Thiokol Chemical Corp., named tech. dir. **Jack Dunnous** appointed dir.—systems development, Process Equipment Dept.

Wilson B. Green and **Emil G. Marcmann** joined the sales force.

Mitchell manufactures the NoVo metering and mixing systems for epoxy resins, urethanes, and other multi-component liquid resins.

The Polymer Corp., Reading Pa.: **Douglas L. Cochran** named gen. mgr. of the newly formed **Whirlclad Div.** to handle the service engineering of Corvel plastics finishes, and the Whirlclad coating system, Polymer's fluidized bed coating process.

Thomas E. Powers appointed sales mgr. of the newly-formed **Molding Resins Div.** to handle sales engineering of Nylatron GS nylon injection molding compound and other specially formulated molding resins produced by Polymer.

The new divs. were previously operated by **National Polymer Products Inc.,** a subsidiary of the Polymer Corp.

Steve Howarth named plant mgr. of **Wilson Organic Chemicals Inc.,** Sayerville, N. J., a recently acquired subsidiary of **Century Chemical Corp.,** New York, N. Y. Wilson is a manufacturer of phthalocyanine dyes and pigments used in vinyl floor coverings and other plastic and rubber products.

Charles A. Sommers Jr. named sales mgr. of **Eljay Corp.,** Baltimore, Md., molders of reinforced plastics parts and fabricators of acrylics, phenolics, decorative laminates, nylon, etc.

D. K. Kauffman, formerly plant mgr. of Plastics Div., named mgr. of mfg. of **The Ceilcote Co.,** Cleveland, Ohio, producers of reinforced plastics ventilating systems and process eqpt.

Joseph C. Profita appointed gen. mgr. in addition to his duties of corporate dir. of marketing of **Narmco Resins & Coatings Co.,** Costa Mesa, Calif., producers of structural laminates and adhesives.

Vernon Hill named dir. of plastics development for **National Cleveland Corp.,** Cleveland, Ohio. He will supervise product development for **Auto-Vac Co.,** a division of National Cleveland that manufactures equipment for vacuum and pressure forming thermoplastics; and for **Auto-Blow Corp.,** a recently formed subsidiary that will build high production blow-molding machines. His 18 years experience in plastics include service with Continental Can and product director of blow molding for Celanese.

William J. Vander Schans named VP—marketing-admin. of **Charles Crowl Co.,** El Monte, Calif., mfrs. of thermoplastic sheet.

Myron L. Bailey named mgr.—sales service div. of **Chemplast Inc.,** East Newark, N. J. fabricator of Teflon.

Richard C. Cole named prod. mgr. **Atlas Vac-Machine Corp.,** Rochester N. Y. mfrs. of heat-sealing and sheet forming machines.

Eugene (Gene) J. Anspach appointed works mgr. of **George Gorton Machine Co.,** Racine, Wis. makers of grinding and milling machines.

Dr. L. Marshall Welch named a VP of **Petro-Tex Chemical Corp.,** producers of aliphatic hydrocarbons. He will continue to direct research and planning activities at the Houston, Texas and Princeton, N. J. labs.

T. W. Brasfield appointed dir. of marketing by **Velsicol Chemical Corp.,** Chicago, Ill. suppliers of styrene copolymers, and aromatic hydrocarbons.

Dr. John Wicklatz, formerly engaged in plastics R & D with Phillips Petroleum Co., joined **The Central Research Laboratories** of **General Mills Inc.,** Minneapolis, Minn., to head the polymer chemistry dept.

E. McKendree Hayden, special asst. to pres., who headed the technical program of **The Stanley Chemical Co.,** East Berlin, Conn., a subsidiary of **The Stanley Works,** for the past 30 years, retired. He was a pioneer in plastisols and organosols.

Robert R. Smith promoted from dir. of packaging sales to dir. of sales of **Du Pont Co. Film Dept.** He succeeds **J. Edward Dean** who became dir. of the **Advertising Dept.**

Sumner E. Tinkham, previously exec. engineer of Boonton Molding Co., joined **Tech Art Plastics Co.,** as VP—engineering.

Ernest D. Carmagnola, design consultant and co-founder of Cecil S. Volk Assocs., named chief engineer, **Jamison Plastic Corp.,** North Bellmore, N. Y., custom molders.

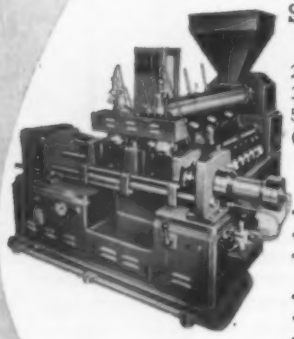
W. G. Potts named asst. mgr., Extruder Sales Div. of **National Rubber Machinery Co.,** Akron, Ohio.

Claude L. Alexander appointed a VP of **American Can Co.** He will continue to supervise **(To page 253)**

ACCURATE
TEMPERATURE MEASUREMENTS
with the all-purpose
PYRO
SURFACE PYROMETER
Quick-acting, portable, with easy-to-read 4-¾" dial. Ruggedly constructed, with 1% meter accuracy. Available in five standard temperature ranges for all plant and laboratory applications.
Send for FREE catalog No. 168.
PYROMETER INSTRUMENT CO., INC.
BERGENFIELD 9, NEW JERSEY

The key to your plant needs!

Blow Molder!
KTS Injection Molder!
Extruder!



Semi Automatic Blow Molder

2-mold model
3-8 pcs/min (cycles)
5"/dia × 11"/hgt
(Size limitation of bottles)

Main Products

- Semi Automatic Blow Molder
- Injection Molder
- Upward Inflation Tubular Film Making Unit
- Extruders - 42, 50 & 75mm
- Extrusion Dies
- Plastic Granulators
- Belt & Tube Take-up Attachments
- Electric Wire Coating Attachments

KATO SEISAKUSHO CO., LTD.
70, 4-chome, Higashi Magome-machi, Ohta-ku, Tokyo, Japan

PERNMOLD*
HYDRAULIC INJECTION MOLDING MACHINE

Fast!
Sturdy!
Efficient!
Economical!

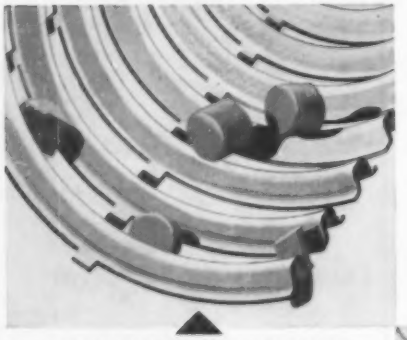
Many Distinctive Features

No toggles to wear out—Die separation stroke 25" Max. 6" Min.—Clamping stroke adjustable 0"—20" Injection pressure 20,000 PSI—Safe Soft Die approach—Plasticizing Cap. 11 Oz.—Emergency die-open button—Tie bar dia. 2-7/16—Finger tip adjustment—No Tie Bar adjustment required—Automatic ejection etc. Detailed Specifications Write for Bulletin P 2-3.

* *Mfg. by Pearne and Lacey Machine Co.*

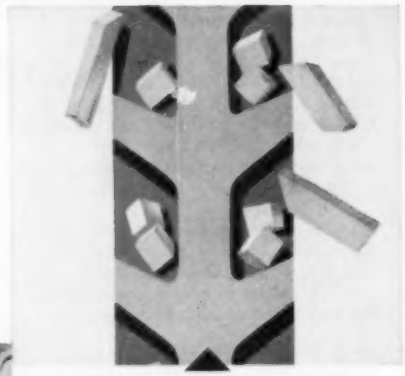
Distributed by
FERNHOLTZ MACHINERY CO. 8468, MELROSE PLACE LOS ANGELES, CALIF.

get accurate sizing with SIMON-CARTER machines



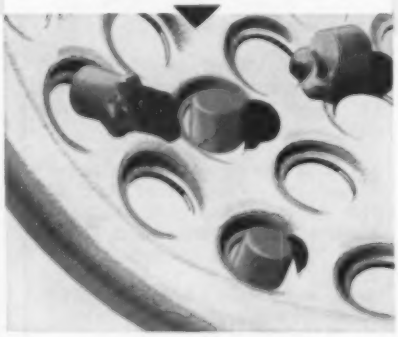
CARTER GRADERS ALSO SIZE AND SEPARATE BY WIDTH

For *width* sizing and separating, the Precision Graders use revolving cylinders with round perforations. Material placed in these cylinders is upended and presented to the round perforations in an endwise position. Narrow pieces pass through, and wider pieces pass over for discharge at the end of the cylinder.



PRECISION GRADERS SEPARATE MATERIAL BY THICKNESS

For sizing and separating free-flowing granular materials by *thickness*, Carter Precision Graders use revolving cylinders with slotted perforations. Material placed in these cylinders is upedged and presented to the slots in an edgewise position. The thinner pieces pass through, and the thicker pieces pass over and are conveyed to the end of the machine.



CARTER SEPARATORS ASSURE POSITIVE LENGTH SEPARATION

Carter Disc Separators contain a series of discs, each of which has hundreds of undercut pockets which select or reject materials according to *length*. As the discs revolve through a mixture of materials, the pockets lift out shorter pieces. Longer pieces, too long to be held in the pockets as they rise, drop away from the discs.

Write today for complete information and descriptive booklets on Simon-Carter machines. Free laboratory testing and demonstrating service.

SC SIMON-CARTER CO. 659 19TH AVENUE N.E. MINNEAPOLIS 18, MINNESOTA

(*From page 251*)

operations of the **Bradley-Sun Div.**, producers of extruded plastics squeeze bottles and tubes, and collapsible metal tubes.

George A. Stein named mgr. of tech. service for **Archer-Daniels-Midland Co.**'s plastics div. He was formerly dir. of plastics research for A. O. Smith Corp., Milwaukee, Wis.

William H. Chadbourne elected pres. of **Fiberfil Inc.**, Warsaw, Ind. He joined the company in Oct. 1958 as gen. mgr. and VP.

Chet Haley named sales mgr. of **Bradley Associates Inc.**, Chicago, Ill. mfrs. of plastic boxes and custom molded containers.

L. Dean Tyler named sales mgr. for Merlon polycarbonate resins by **Mobay Chemical Co.**, Pittsburgh, Pa. He is succeeded by **William A. McGregor** as mgr.—foam and specialty chemical sales.

Herbert F. Schaefer appointed to the newly created post of mgr.—market development for **Hercules Powder Co.**'s Synthetics Dept.

Wayne W. Camp named tech. rep. in the Midwest and East by **Ren Plastics Inc.**, Lansing, Mich., formulator of epoxy resin for tools and tooling. He will have headquarters at 2002 Joffre Ave., Toledo, Ohio.

Dr. George W. Walpert appointed sr. research engineer for **The Kordite Corp.**, Macedon, N. Y. mfr. of polyethylene films. He will be responsible for applied research in the areas of new polymer films.

John M. Waters appointed dir. admin. services for **Plax Corp.**, Hartford, Conn.

Val Reisig named asst. advtg. mgr., plastics div., **Eastman Chemical Products Inc.**, subsidiary of **Eastman Kodak Co.**

Earl A. Erich elected VP of **Tube Turns Plastics Inc.**, Louisville, Ky., an affiliate of **Chemetron Corp.**, Chicago, Ill.

New reps.

Hercules Trading Corp., Wilmington, Del., by arrangement with **Harrisons & Crosfield (Canada) Ltd.**, has appointed **Canadian Industries Ltd.** distributor of Hi-Fax high-density polyethylene. C-I-L already distributes Pro-Fax polypropylene and Penton chlorinated polyether, all produced by Hercules . . . **John H. Calo Co.**, New York, N. Y. distributor for **Hercules Powder Co.**, established bulk storage facilities in northern N.J. for **(To page 254)**

Hot-Stamping is Part of Our Service, Too

Complete Design, Engineering, Production & Finishing Operations

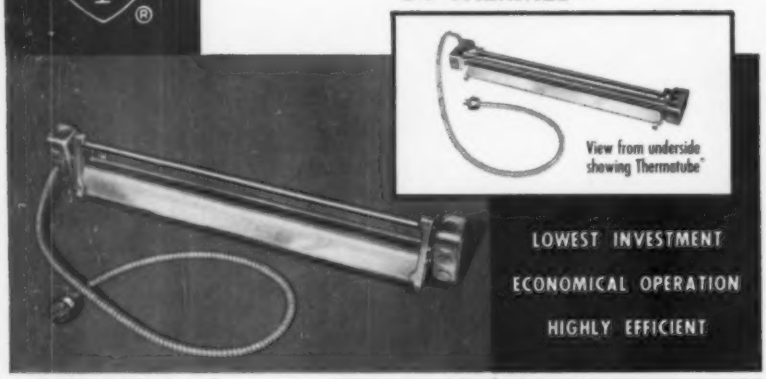
SERVICES
Designing
Engineering
Mold-making
Hot stamping
Spray painting
Buffing
Sanding
Tapping
Drilling
Metal inserts
Inspection
Assembly
Testing

Sure, we're molders. Have been for 45 years. But our operations don't stop there. We can handle the *complete* job — from the design stage to delivery of your finished part or product. For example, we do hot-stamping. This offers extensive opportunities for decorative or functional treatments. May we tell you more about our services? Just drop a line on your company letterhead to . . .

THE WATERTOWN MANUFACTURING CO.
1000 ECHO LAKE RD., WATERTOWN, CONNECTICUT

New! **Radiant Heater Assembly**

BY THERMEL®



- **HEAT SOURCE** Alloy Sheathed Thermotube®.
- **REFLECTOR** Highly Polished Lighting Grade Aluminum.
- **SECONDARY INSULATION** Tubular Element Insulated with Ceramic Bushings at all Mounting Points.

Write for list of Extra Accessories Available. Special Sizes Made to Order. Two Weeks Delivery.

STANDARD SIZES					
Cat. No.	Volts	Watts	E.H.L.	O.A.L.	List Price
TR-18	120 or 240	750	18"	24"	$16.90
TR-24	120 or 240	1000	24"	30"	$18.85
TR-30	120 or 240	1250	30"	36"	$22.00
TR-36	120 or 240	1500	36"	42"	$25.20
TR-42	240	1750	42"	48"	$28.40
TR-48	240	2000	48"	54"	$31.60
TR-54	240	2250	54"	60"	$34.80
TR-60	240 or 440	2500	60"	66"	$39.60
TR-66	240 or 440	2750	66"	72"	$42.80
TR-72	240 or 440	3000	72"	78"	$46.00
TR-78	240 or 440	3250	78"	84"	$49.20

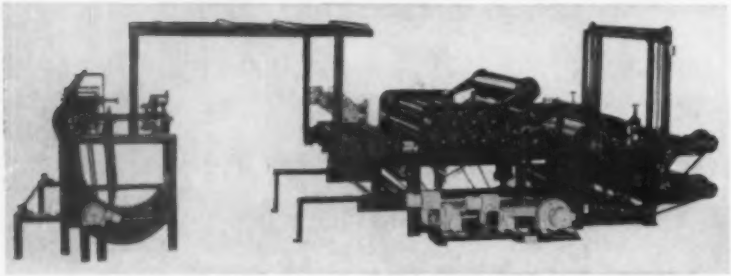
Please specify voltage when ordering.

Thermel, inc.

9410 W. Robinson Rd., Franklin Park, Ill.

Process Film ***Faster for Less . . .***

with the LIBERTY EMBOSSER-LAMINATOR



Specially Designed to Speed Output on Vinyl, Coated Fabrics!

Speeds up to 35 yds./min. made possible by 10 electrically heated rollers.
Laminates up to 3 ply and any combinations.
Proper rate of travel assured by variable speed control.
Clean, trouble-free performance thanks to electrical operation.
Internally cooled chrome and engraved rolls.
Smaller models available at correspondingly lower prices.

For further details of Liberty's processing equipment —including *polishing units, embossers, one and two-color presses, inspection units and a new line of slat expanders* —write for Liberty's free catalog!

LIBERTY MACHINE CO. INC.

275 FOURTH AVENUE, PATERSON 4, N. J.

COMPANIES...PEOPLE

(*From page 253*)

Hercules' Pamak tall oil fatty acids, which are used in plasticizers, floor coverings, and other products. . . .

Barclay Industries Inc., 420 Lexington Ave., New York 17, N. Y., is the American rep. for **Johann Fischer Co.**, Lohmar, W. Germany mfr. of extrusion and blow molding equipment; **A. Nothelfer & Soehne**, Ravensburg, W. Germany mfr. of the Nora rotary injection molding machine; **Covema s.r.l.**, Milan, Italy, for its line of continuous vacuum forming machines; and **Winkler & Fallert Co. Ltd.**, Berne, Switzerland mfr. of a 4-color rotary offset press for bottles. . . .

Thompson-Hayward Chemical Co., Kansas City, Mo., appointed by **Pittsburgh Plate Glass Co.** as distributor of Selectron polyester resin products in 15 states of the mid-continent area of the U. S. . . . **Clarke Associates**, 13 Happy Hollow Rd., Wayland, Mass., appointed New England rep. for **Stewart Bolling & Co. Inc.**, Cleveland, Ohio mfr. of plastic and rubber processing machinery, mills, intensive mixers, calenders, hydraulic presses, extruders, and related equipment. . . .

Don Maier & Associates, 6214 W. Manchester Ave., Los Angeles 45, Calif., named rep. in Calif. and Arizona of **Joseph M. P. Ott Mfg. Co. Inc.**, Pawtucket, R. I., Fiber Glass Fabrics Div., and will also handle other industrial fabrics including Dynel, Fortisan, Dacron, etc. . . . **L. C. Morris Co.**, 1186 Dalon Drive, N.E., Atlanta, Ga., appointed exclusive sales agent in the southeastern states for Hetron polyester resins for **Durez Plastics Div.** of **Hooker Chemical Corp.** . . .

Acme Machinery & Mfg. Co. Inc., 20 S. Broadway, Yonkers, N. Y., appointed New York rep. for **Sterling Inc.**, Milwaukee, Wis. mfr. of heating and temperature control products. . . . **Markem Machine Co.**, Keene, N. H., named exclusive distributor by **Cosom Engineering Corp.**, Minneapolis, Minn., for its Cosomatic semi- and fully-automatic machines for single- and three-color decorative and identification marking of flat and cylindrical shapes widely used in the plastic food container field.

Corrections

"1959—Year of application breakthroughs" (MPl, Jan. 1960, p. 121): School furniture shown in top photo is Study Center made by American Seating Co., Grand Rapids, Mich.

"Plastics in the product revolution: The Telephone" (MPl, Jan. 1960, p. 126): The 11¼-ft. high bank for dial switch equipment weighs approximately 2000 pounds.—**End**

now for continuous
PLASTIC FOAMING

ARMORBELT
foaming conveyor

Miles of high quality wide slab foam have been faultlessly produced on Armorbelt — the ideal conveyor for foaming plastics . . . and Here's How!

ELIMINATES LAYER SEPARATION:
Armorbelt's patented design, increases production—assures high quality foam, eliminates profit robbing layer separation.

EASY TO CLEAN — CORROSION-RESISTANT:
Armorbelt features a smooth, corrosion-resistant metal belt — easy to remove spilled compound.

BUILT-IN FEATURES:
Armorbelt's convenient, easy to reach controls, give you rapid change of bun width, angle of tilt and conveyor speed.

DESIGNED TO MEET YOUR PRODUCTION NEEDS:
Armorbelt foaming conveyors are designed in widths up to 8 feet, in lengths to meet your plant requirements.

For quality foaming at LOWEST COST . . . Install an Armorbelt Plastic Foaming Conveyor in your plant.

WRITE OR PHONE FOR DETAILED INFORMATION

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SOLVE YOUR PACKING PROBLEMS at Low Cost with

PARTITIONS
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FOR PROTECTIVE PACKAGING

WRITE, PHONE, WIRE for QUOTATIONS on YOUR REQUIREMENTS

Peter Partition Corp. operates one of America's *largest* plants devoted *exclusively* to the production of cardboard partitions.

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Manufacturers of Cardboard Partitions
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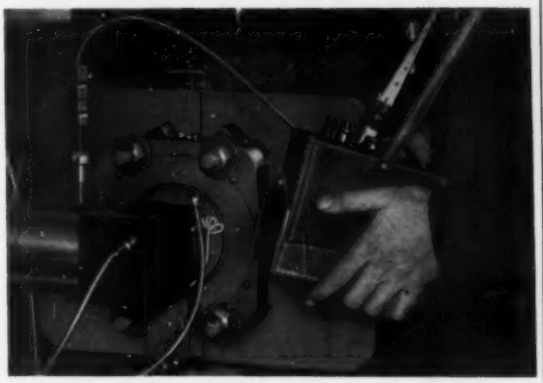
Telephone: TRiangle 5-4033

Check Actual Stock Temperatures Quickly Accurately

With T-E's Three-Unit Package

"MiniMite" Pyrometer Indicator



COURTESY—NATIONAL RUBBER MACHINERY CO.
Checking stock temperature with T-E's three-unit package

For fast, convenient and highly accurate quality control of plastic extrusions—T-E's three-unit, temperature measuring package is ideal. With it you can check actual stock temperatures—and then correlate these to controllers for correct settings. It helps you avoid production losses during start-up or when ambient conditions vary. The package includes T-E's (1) "Plastic Melt" thermocouple, (2) "MiniMite" Portable Pyrometer Indicator and (3) extension wire with jack connector. With the "Plastic Melt" thermocouple installed in the extruder, the "MiniMite" can be connected in seconds to provide a rapid reading. Accurate to ¼ of 1% of scale range, the four lb. "MiniMite" can also be used to check other thermocouples or to calibrate controlling instruments.

Write for Bulletin 3-17.

Thermo Electric Co., Inc.
SADDLE BROOK, NEW JERSEY
In Canada — THERMO ELECTRIC (Canada) Ltd., Brampton, Ont.

T-E's "Plastic Melt" Thermocouple

CLASSIFIED ADVERTISEMENTS

EMPLOYMENT • BUSINESS OPPORTUNITIES • USED OR RESALE EQUIPMENT

Machinery and Equipment for sale

MUST LIQUIDATE EQUIPMENT PRICE IS NO OBJECT! Modern F-B 2 Roll Mills, 14" x 30"; 16" x 42"; 22" x 60"; Roll Calender 22" x 58" Latex Pouring Curing Line Truck Dryers; 30" and 100' Adamson Vulcanizers 6' x 16' Baker Perkins Mixers to 300 Gal. Banbury Lab Size B Mixer 2 Stokes Vacuum Impregnators Stokes Aut. Molding Presses Southwark-Dunning-Boschert French Oil Mill Hydr. Presses Extruders: Royle No. 1; Allen 2" MPM 4½" and MPM 1½". Utility Stock Cutter 9" wide. Send for Complete List. First Machinery Corp., 209-10th St., Bklyn. 15, N.Y. ST-8-4672; Cable "Effemey."

FOR SALE: 1957 AUTO-VAC Model EQA, 30" x 50", with roll feed and skin packaging attachment. Four column upmoving toggle-operated hydraulic press, 30" x 50" bed, with power unit. Trims any formed part to .060" thick. Both used less than 1000 hours. Photos available. North Star Industries Inc. 2418 University Avenue SE. Minneapolis 14.

FOR SALE: 1 Baker Perkins 100 gal. Sigma blade Mixer; 1 Baker Perkins size 16 TRM 150 gal. double arm Vacuum Mixer; 1 Rotary Cutter; 1 Kent 6" x 14" three roll Mill; 6 Stokes Model DD2, DS3, D3, and B2 Rotary Preform Presses; 4 Stokes Model "R" and R-4 single punch Preform Presses. Also: Sifters, Banbury Mixers, Powder Mixers, etc., partial listing; write for details; we purchase your surplus equipment. Brill Equipment Co., 35-55 Jabez St., Newark 5, N.J. Tel. Market 3-7420.

FOR SALE: 3 electrically heated plastics extruders, 4½", 2½" and 1½"; 2 Cumberland 7" stair step dicers, stainless steel; 1 Baldwin Southwark 150 ton self-contained compression molding press; 2 Ball & Jewell rotary cutters, models ½ and 1; 3 Stokes preform presses, models R, T and F; also mills, mixers, etc. Chemical & Process Machinery Corp., 52 9th Street, Brooklyn 15, N.Y. HY-9-7200.

FOR SALE: 4 New Farrell Birm. 14" x 30" two roll mills. Watson Stillman 240 ton, ten 24" x 56" platens. Baldwin South. 200 ton semi-automatic transfer molding press. Baldwin South. 150 ton downstroke, 48" x 40" platens. French Oil 120 ton self-contained. Upstroke, 29" x 21" platens, 12" stroke. 60 Ton Farquhar 50" x 50" platens, 30" stroke. Stokes 50 ton semi-automatic 22" x 12" platens. 50 ton Birdsboro 24" x 20" platens. 30 ton Birdsboro 21" x 14" platens. Hydraulic pumps and accumulators. Unused ¾ oz. Bench Model Injection Machines. Van Dorn 1 oz. and 2 oz. Other sizes to 100 oz. Baker Perkins and Day jacketed mixers. Plastic Grinders. Seco 6" x 12" and 8" x 16" mills and calenders. MPM 3½" wire covering Extruder. New ¾" Plastic Extruder and other sizes up to 6". Stokes BB2 and RD3 Rotary-Preform Tablet machines, also single punch ½" to 4". Partial listing. We buy your surplus machinery. Stein Equipment Company, 107—8th Street, Brooklyn 15, New York.

FIFTY LATTNER BOILER dealers throughout the country have used and like new automatic steam boilers for sale. Small sizes ½ to 35 H.P. Gas, oil or electric fired. Write for name of dealer near you. Lattner Mfg. Co. Cedar Rapids, Ia. Box 1710.

FOR SALE: 600 Ton Compression Press, 24" Downacting ram, 36" stroke, two 8" pushback cylinders, "T" slotted beds, 38" left to right, 41" front to back, self-contained. Loranger Plastics Corp., Warren, Penna. Telephone RAndolph 3-8600.

FOR SALE: Ovens, Grinders, Powder Mixers, Injection Molding Machine 1 oz. to 60 ozs. never used and used. Two-head Bottle Blowing Machine. Acme Machinery & Mfg. Co. Inc., 20 South Broadway Yonkers, N.Y. YOnkers 5-0900. 102 Grove Street, Worcester, Mass. PLeasant 7-7747.

1—TRANSFER MOLDING PRESS: Cambridge Press—600 Tons. Platen Size: Rt. to left, 44"; Ft. to back, 30"; Between columns, 35"; Rt. to left, 35"; Ft. to back, 35"; Ram size, 20"; Stroke, 20"; Transfer Ram, 10"—100 Tons; Stroke, 16"; Daylite, 37". Pumping Unit, 2—30 Gal. Racine Pump, 1000 lb. pressure. 100 Gal. Oil Tank, 1—3 to 1 Racine Booster for 3000 lb. line pressure. 1—TRANSFER MOLDING PRESS: Frisch Press—400 Tons. Platens, 35" x 35"; Between columns, 24" x 24"; Ram size, 16"; Stroke, 20"; Daylite, Adjustable—28½" to 44". Pumping Unit, 2—30 Gal. Racine Pumps, 1000 lb. pressure. 100 Gal. Oil Tank, 1—3 to 1 Racine Booster for 3000 lbs. line pressure. Sperzel Company, 2845 Harriet Avenue, Minneapolis 8, Minn.

FOR SALE: Stainless reactors or resin Kettles: 3500, 2200, 1900, 1300, 1000, 750, 500, 350 gal. jktd. and agit. Baker-Perkins dbl. arm mixers: 200, 100, 50 gal. capacity, steel or stainless. Perry Equipment Corp., 1429 N. 6th., Phila. 22, Pa.

MOST MODERN PACKAGING AND PROCESSING MACHINERY — available at great savings: Baker Perkins JNM-2, 50 gal. Stainless Steel Heavy Duty Double Arm Mixer with Hydraulic Tilt. Baker Perkins, W & P and Day Double Arm Steam Jacketed Heavy Duty Mixers —50, 75, 100, 150 and 200 gal. capacities. Day 2½ gal. MDA Mogul D.A. Vac Experimental Mixer. Fitzpatrick Models D, D-6 and K Stainless Steel Comminuters. Werner & Pfleiderer 3,000 gal. and 3,500 gal. Jacketed Double Arm Mixers. Stokes Models R, RD-1 and DD2 and Eureka Tablet Machines. Colton 2RP, 3RP, 3B, 5½ T Tablet Machines. Mikro Pulverizers, Models 1SH, 2TH, 3TH and 4TH. Day, Robinson 50 to 10,000 lbs. Dry Powder Mixers. Jacketed and Unjacketed. Package Machinery, Hayssen, Scandia, Wrap King, Campbell, Miller Wrappers. Pneumatic Scale Automatic Carton Feeder, Bottom Sealer, Wax Liner, Top Sealer with Interconnecting Conveyors. Pneumatic Scale Tite Wrap. Standard Knapp, A-B-C, Ferguson Carton Sealers. Union Standard Equipment Company, 318 Lafayette Street, New York 12, N.Y. Phone: CAnal 6-5334.

FOR SALE: China Plastic Company blow molding machine with 3-inch extruder and double head. Can be automated. Almost new. May be test run in our plant any time. Molds available. Price: $3,500.00. Call or write Knickerbocker Plastic Co., Inc., 11501 Hart Street, North Hollywood, California. Phone Triangle 7-5281.

PLASTIC EQUIPMENT: 60 oz. HPM Injection Molding Machine, Late Type. Inspect on Location. Complete with all controls and equipped with Glengarry weigh feed and mold cooler. Model R-4 Stokes Tablet Press. Complete with 5 HP U.S. Vari-Drive, New in 50's, Excellent Condition. 2 oz. Van-Dorn Injection Molding Machine, Model H-200, Semi-Automatic Operation. Complete with wheelco controls and timers. 4 yrs. old. 600 Ton Adamson Multi-Opening Hydraulic Press. 26" diameter chrome plated ram, slab side construction. Press contains nine 42" x 42" platens. Late Type. Transfer Press. 75 Ton Baldwin-Southwark. Completely self-contained with operating controls. 12 oz. Watson-Stillman and 8 oz. Reed Prentice Injection Molding Machines. Plastic Extruders—NRM 2½", Royle 3½", Hartig 3½", Adamson 6", Farrel 3". Also a complete line of Blenders, Mixers, Scrap Cutters and other equipment for the Plastic and Rubber Industry. What Do You Need? What Do You Want? We Will Finance. Johnson Machinery Company, 683 Frelinghuysen Avenue, Newark 12, New Jersey. BIgelow 8-2500.

FOR SALE: One Van Dorn 1 oz. lever controlled, Model H-200 Injection moider with a 2 HP, 115/230 Volt, single phase motor. In good condition. Plastics Incorporated, P.O. Box 2650, New Orleans 16, La.

FOR SALE: 1—Adamson United 1,000 ton, 2—19" openings, 2—24" rams complete with all valves and 24" stroke, 38" daylight. Brewster Rubber Machinery Co., 349 E. Exchange Street, Akron 4, Ohio, FRanklin 6-6791.

INJECTION MOLDING Machine, H P M 9 oz., $4250.00. 1—150 gal Day Imperial Mixer. 1—16 x 36 Mill 1—180 cubic ft. Powder Blender. Louis Sussman, Inc., 800 Wilson Ave., Newark, N. J. MI 2-7634.

FOR SALE: Fellows 8 oz. molding machine, new in 1955. Low pressure closing. Leeds & Northrup instruments. Has been well maintained and is in excellent running condition. May be seen in operation. Sterling Plastics Co., 1140 Commerce Ave., Union, New Jersey.

Machinery wanted

WANTED TO BUY: Used injection molding machines, oven, granulators. One machine or complete plant. Acme Machinery & Mfg. Co., Inc., 20 South Broadway, Yonkers, N.Y. YOnkers 5-0900, 102 Grove Street, Worcester, Mass. PLeasant 7-7747.

WANTED—Used Comb Molds and 6 or 8 oz. Injection Molding Machine for use in Mexico. All sizes of combs desired. Please reply Box 6438, Modern Plastics.

NEED SPARE 16 oz. HPM Injection Cylinder Assembly in good condition to fit machines made 1945-6-7. P.O. Box 216—Station A, Meriden, Conn.

MACHINERY WANTED: 1 Stokes #741 Press 150 Ton capacity. 1 Preform Machine 3 x 4 x 1½ capacity. Write or phone, Norton Laboratories, Inc., Lockport, New York. Telephone LOckport 3-6751. Attention Mr. H. Bowman, Plant Engineer.

WANTED TO BUY: 1—6" Plastic Extruder, electric heated complete, 2—22" x 60" Plastic Mills complete with motor and drive. Brewster Rubber Machinery Company, 349 E. Exchange Street, Akron 4, Ohio, FRanklin 6-6791.

Materials for sale

FAMCO VEIL MAT—Part #560125, 319,000 Sq. Ft., Surfacing Mat. Type "500 F" which has a low binder content recommended for flat sheets and gently curved products. .010" thick. 24" wide. 280' long (nominal). J. B. Quinn, The Brunswick-Balke-Collender Co., 2560 East Kilgore Road, Kalamazoo, Michigan.

FOR SALE: P/E Blow Molding and Houseware Compounds made to fit your job. H.I., M.I. and G.P. P/S, Acetate, Propylene, Butyrate. For quality, price and service call AX 1-5550. Amco Plastics Processors, 183-02 Liberty Avenue, Jamaica 12, New York.

3 OZ. ROVMAT—SURPLUS 19,000 lbs. of 2 oz. weight, 20 end continuous rovings spaced 3 to the inch. 3" wide rolls. Produced by Fiber Glass Industries. Will sell at bargain price. J. B. Quinn, The Brunswick-Balke-Collender Co., 2650 East Kilgore Road, Kalamazoo, Michigan.

FIBERGLAS MAT: Short pieces, short rolls, non standard widths and weights. 50,000 lbs. now available at ½ regular prices and less. Top quality soluble binder and press mat available in addition to a regular supply of cut offs. Reply Box 6468, Modern Plastics.

Materials wanted

WANTED: All types of plastic scrap and surplus inventories such as: styrenes, butyrates, acetate, acrylics, and polyethylenes, in any form. Write, Wire or Phone Collect. MAdison 3111. Philip Shuman & Sons, 571 Howard Street, Buffalo 6, New York.

(Continued on page 258)

BALLS UNLIMITED

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Company _____

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(Continued from page 256)

WANTED: Plastic of all kinds—virgin, reground, lumps, sheet and reject parts. Highest prices paid for Styrene, Polyethylene, Acetate, Nylon, Vinyl, etc. We can also supply virgin & reground materials at tremendous savings. Address your inquiries to: Gold-Mark Plastic Compounds, Inc., 4-05 26th Ave., Long Island City 2, N. Y. RAvenswood 1-0880.

POLYESTER RESIN WANTED: Off standard, gelled, discontinued, off color, etc., any quantity. Also, pigments, peroxides, glass cloth and mat, etc. Reply Box 6467, Modern Plastics.

GET THE TOP MONEY FOR PLASTIC SCRAP: Now paying top prices for all thermoplastic scrap. Wanted: polystyrene, cellulose acetate, vinyl, polyethylene, butyrate, acrylic, nylon. All types and forms including rejects and obsolete molding powders. Fast action wherever you are located. WRITE, WIRE, TODAY! Reply Box 6469, Modern Plastics.

WANTED: Urgently need any quantity of colored and crystal Butyrate Scrap, Sheet Trim, Purgings, Parts, Reground. Claude P. Bamberger, Inc., Ridgefield Park, N.J., HUbbard 9-5330.

Molds wanted

WANTED: Obsolete molds of animal figures and animal heads. Send complete information. Reply Box 6439, Modern Plastics.

MOLDS WANTED: Complete lines or individual items for injection molding. Outright purchase only. Nicole Ribbon Co., 963 Newark Ave., Elizabeth, N.J.

WISH TO PURCHASE Houseware Molds of all types for injection molding. Please submit full information. Reply Box 6462, Modern Plastics.

Help wanted

CHIEF MOLDING ENGINEER: We are seeking an outstanding man to take full responsibility for the operations of our 17 machine injection molding plant. This man should have 7-10 years of experience in the field, strong administrative and supervisory background, as well as experience in cost control and reduction. In addition, an engineering background is desirable. This position offers a five figure salary commensurate to experience, profit sharing and other benefits. More important, it provides the opportunity to grow along with one of the most rapidly expanding manufacturers of consumer products. Write or call Mr. R. Gordon, Remco Industries, Inc., 113 North 13 St., Newark, N.J. HU 4-1700.

SALES REPRESENTATIVES WANTED for established Pearlescent Pigment Manufacturer. Knowledge of plastic compounding and coating industries required. Several choice territories open. Rona Laboratories, Inc., Bayonne, N.J. He. 7-0800.

COMPRESSION SUPERINTENDENT: Challenging opportunity for top-notch compression molding supervisor to take complete charge of department. Minimum 5 years supervisory experience, knowledge of all compression molding materials, equipment and latest techniques required. Growing progressive Southern California company offers excellent growth potential to right man. Olympic Plastics Company, Inc., 3471 S. La Cienega Blvd., Los Angeles 16, California.

PLANT MANAGER: Large well established company entering urethane foam field seeking a highly qualified man to assume complete charge of modern polyurethane foam plant. One shot polyether foam experience desirable. Substantial remuneration for right man. All replies will be considered promptly and held in confidence. Please send detailed resume of education and experience to Box 6440, Modern Plastics.

SUPERVISING ENGINEER: Experienced plastics engineer required by multi-line molder to supervise engineering group. Degree preferred but not required. Must be proficient in tool design and estimating. Ability to organize team and accept responsibility necessary. Expanding company offers challenging opportunity. Olympic Plastics Company, Inc., 3471 S. La Cienega Blvd., Los Angeles 16, California.

DEVELOPMENT ENGINEER: Here is a top opportunity for a graduate Ch.E. experienced in polyethylene extrusion to join the research and development team of a growing national flexible packaging manufacturer. The man hired will be responsible for operation and development work for a pilot plant extruder. Salary open. Write Don McConnell, giving full details. The RAP-IN-WAX Company, 150—26th Ave. S. E., Minneapolis 14.

MARKET DEVELOPMENT: Opportunity to join Spencer Chemical Company's expanding Plastics Market Development program in a position which will permit the use of sales and technical abilities. We are seeking men who have a chemical or engineering background, and preferably three to five years' experience with thermoplastics. Please send detailed resume to: W. H. Swope, Jr., Personnel Manager, Spencer Chemical Company, 610 Dwight Building, Kansas City 5, Missouri.

TOP-FLIGHT MECHANICAL ENGINEER, with background in injection molding industry. Knowledge of custom molding is a requisite; must have experience in production, maintenance, mold design and estimating. Salary open. Located in upstate New York. Reply Box 6441, Modern Plastics.

INJECTION MOLDING SUPERVISOR: Complete Charge. Long Established, Large Plant, Eastern, U. S. State Qualifications in detail. Reply Box 6450, Modern Plastics.

POLYESTER MANUFACTURER requires experienced plastics engineer to head up development and service group in preform and premix molding. Technical education required. Position offers good starting salary and future opportunity. Liberal benefit plans. Excellent laboratory facilities. Send resume to Mr. E. R. Frank, Pittsburgh Plate Glass Research Center, P. O. Box 127, Springdale, Pennsylvania.

PLASTIC SHEET EXTRUSIONIST: Mechanically skilled man with good working knowledge and experience in high impact sheet extrusion. Man must have ability in handling mechanical production problems and plant personnel. This is a responsible permanent position with an expanding Chicago company offering positive further advancement. Good salary commensurate with ability. Excellent working conditions. Replies confidential. Reply Box 6446, Modern Plastics.

REPRESENTATIVES WANTED: Men calling on injection molders, vacuum formers, extruders, to add additional line. Write advising lines presently represented. Reply Box 6449, Modern Plastics.

SALES REPRESENTATIVES WANTED: Parent corporation has openings on a national basis for established authorized manufacturers' representatives on strict commission basis in various divisional organizations. 1. Durable Formed Products, Inc. Sales representatives wanted to solicit industrial accounts for thermoformed and fabricated products in formable plastics. 2. Air-O-Flow Industries, Inc. Agents wanted who specialize in sales of plastic machinery to sell automatic thermoforming equipment. 3. Techni-Plastics, Inc. Specialized sales for custom acrylic work, engraved panels, dials and lighting diffusers. Indicate territory you cover. Write to: Durable Industries, Inc., Chemical Corn Exchange Bldg., 74 Varick Street, New York 13, N.Y.

WANTED: Representative in Detroit area for custom injection and blow molded plastic products. Reply Box 6443, Modern Plastics.

WANTED: PRODUCTION SUPERVISOR with some experience on Vinyl Coated Fabrics. Good opportunity with long established, progressive company. Man selected would work directly under plant manager. Also open, position for Chemist. Plant in Southern New England area. Send complete resume with salary requirements. Reply Box 6455, Modern Plastics.

FLORIDA VINYL EXTRUSION EXPERT: Foreman needed to take charge of progressive small plant Central Florida, thoroughly familiar with PVC profile extrusion and experienced in the development of dies. Replies will be kept in strictest confidence. Steady position with good future. Please address resume and salary requirements to Box 6451, Modern Plastics.

SALES EXECUTIVE ENGINEERING BACKGROUND: Proven record of plastic product development essential for most challenging position. Organization aware of ad. Replies held in strictest confidence. Reply Box 6458, Modern Plastics.

PLASTIC ENGINEERS: Openings in Applications Research Laboratory in North Jersey Metropolitan area. Degree in Chemical or Mechanical engineering required; some experience in extrusion, injection molding or compression molding of plastics desirable. Positions involve laboratory applications work and customer service. Liberal company benefits. Send complete resume and salary requirements to: Personnel Department, Plastics and Coal Chemicals Division, Allied Chemical Corp., 40 Rector St., New York 6, N.Y.

PACKAGE DEVELOPMENT: Spencer Chemical Company offers an excellent opportunity for a young man with several years' experience in handling and designing packaging equipment to join its strong packaging group. Experience in the converting of film, such as printing, treating, or laminating, is desirable. Please send complete resume of background and experience to: W. H. Swope, Jr., Personnel Manager, Spencer Chemical Company, Dwight Building, Kansas City 5, Missouri.

EXTRUSIONS SPECIALIST with thorough knowledge and experience in setup of extruded precision shapes, close tolerance of various shapes of vinyl extrusions. Must also be experienced in die making, and extruded rigid vinyl. A real opportunity for the right party. Reply: Everglades Plastic Corp., P. O. Box 1445, Hialeah, Florida.

SPECIALTY PAPER SALESMAN: Position presents unusual opportunity for experienced salesman capable of making contacts and presentations of top levels in direct Sales. Experience in paper or related industry preferred. Northeast location. Requires travel. Growth Company. Exceptional benefits. Reply Box 6459, Modern Plastics.

MANUFACTURERS REPRESENTATIVE: Plastic packaging products and materials wanted for sale in rapidly expanding Southern California market. Opening new office about April 1. Extensive packaging sales and management experience. Well acquainted with large volume package buyers. Strong creative ability. Reply Box 6453, Modern Plastics.

PLANT MANAGER: Minimum 5 years responsible experience in injection molding production. Due to unusual potential of this position, candidate should have above average capacity for broad personal growth. Location in Southern New England with young public-owned growth company. Opening due to promotion of present incumbent. Replies confidential—should include complete qualifications and salary requirement. Reply Box 6457, Modern Plastics.

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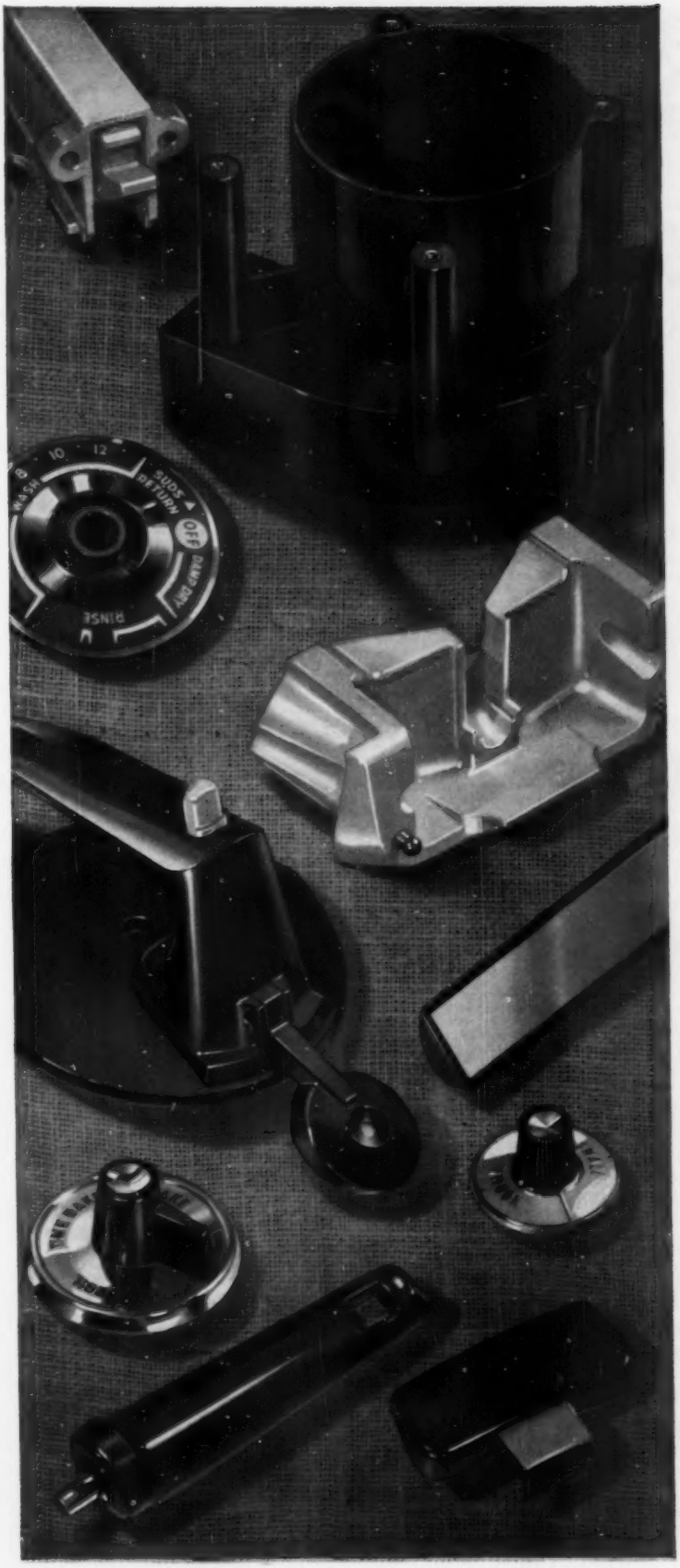

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NATIONAL PLASTICRAFTERS, INC.
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(Continued from page 258)

PLASTIC FOREMAN: Must have production experience in thermoforming. Man selected will assist in establishing manufacturing plant in Southwestern area. Opportunity for advancement to management position. Send complete resume and salary requirements. Reply Box 6448, Modern Plastics.

PLANT MANAGER: Full responsibility for compression and injection molding, finishing, supporting activities. Labor relations. SHIFT FOREMAN: Compression pressroom. Due to expansion. FINISHING METHODS: Engineer or Technical Foreman. Very large custom plant in Buffalo area. Pertinent experience and technical background necessary in all vacancies. Replies held confidential. Reply Box 6445, Modern Plastics.

COLORIST: Top company needs man experienced in coloring extruded thermoplastics; emphasis on production and quality control. Chicago location, all benefits. Submit complete details in first letter. Reply Box 6447, Modern Plastics.

TECHNICAL DIRECTOR—Research Division of major packaging converter seeks to fill key position of Technical Director. Desire man with advanced Chemical or Mechanical Engineering degree, with administrative and supervisory experience of an industrial research laboratory. Background in industrial chemistry and mechanical design desirable. Upper Midwest location. Good earning and benefits. Your resume will be held in strictest confidence. Reply Box 6442, Modern Plastics.

WANTED SALES REPRESENTATIVES: Major Plastic Molding Firm requires several agressive sales personnel. These additions will augment our present sales force. A knowledge of plastics is desirable and applicants must have a degree in Engineering, Chemical or Mechanical. We are willing to train the right men. Assignments would be in the East and mid-West. Submit complete resume to L. T. Lombard, Mgr. Employee Relations, Haveg Industries, Inc., Taunton Division, 336 Weir Street, Taunton, Massachusetts.

FILM SALES: Unusual opportunity exists for experienced polyethylene film salesman with new division of nationally known company. Experience must include selling to industrial and converter accounts on Eastern Seaboard, or in East-North-Central area. This is a real chance to get in on the "ground floor" of a dynamic growth situation; consequently, the individual we are seeking must have the potential for broad personal growth. Reply in strictest confidence giving full details of your education, experience, and salary requirements, to Box 6461, Modern Plastics.

POLYMER CHEMISTS: For challenging positions in expanding natural and synthetic polymers research program. Duties involve development and applications research in plastics and some technical service work. Openings for B.S. or M.S. chemists with interest in re-inforced plastics, coatings, plastisols or in pigment and polymer dispersion. Experience helpful but not necessary. Ground floor opportunity in research program which has quadrupled since 1956. Modern facilities in new 138 lab unit research center to be occupied in late 1960. Good potential for advancement into senior or administrative research positions, market development or technical sales. For detailed information write to G. M. Prust, A. E. Staley Manufacturing Company, Decatur, Illinois.

PERSONNEL: Executive—Technical—Sale—Production. Employers and Applicants—whatever your requirements, choose the Leader in Personnel Placement. Cadillac Associates, Inc., Clem Easly—Consultant to Plastics Industry, 29 E. Madison St., Chicago, Ill.—Financial 6-9400. Call, write or wire—in confidence.

SALES REPRESENTATIVES: Wanted by Custom Plastic Injection Molding company located in New York State. We are interested in men or organizations now calling on Industrial accounts. We have the most modern up-to-date facilities available, specializing in large volume Automatic Molding of small items, such as, cigar mouth-pieces, closures, spouts and aerosol components, etc. Choice territories. Give resume. Confidential. Reply Box 6463, Modern Plastics.

TECHNICAL SALES—ISOCYANATES: Young Ch.E. or chemist wanted for field sales work requiring some understanding of rubber and plastic technology. Training and introductory period will lead directly to self supervising field selling. We require integrity, intelligence and energy in that order, and offer a permanent position with growth potential. Starting salary $6500 to $9000 for two to five years experience. Please send resume to: Richard Kithil, Vice President, The Carwin Company, North Haven, Connecticut.

EXTRUDER OPERATOR with group leader potential, experienced in custom extrusion of profiles and tubing in thermoplastics. Opportunity for rapid advancement with four year old company, in new extrusion plant. Pleasant working and living conditions, fringe benefits. Replies held in confidence, our employees know of this ad. Quick Plastics, Box 66, Jackson, Michigan.

SALES REPRESENTATIVES WANTED: Well established distributors and reprocessors of thermoplastic molding and extrusion materials requires experienced sales representatives. Territories open: Chicago and other midwestern areas; Southern States; Canada. Reply Box 6473, Modern Plastics.

Situations wanted

SUPERVISOR: Injection Molding—Age 37—10 years experience. Working knowledge of all Thermoplastics, Production control, Quality control, Machine maintenance and repair, customer contact. Mold design. Will assume full responsibility in supervision of Plant and Personnel. Willing to relocate. Reply Box 6452, Modern Plastics.

PLANT SUPERINTENDENT—TECHNICAL DIRECTOR of large bulk Polystyrene and Polyurethane plants in South America. Extensive consultation work in final applications of these products. 10 yrs. previous experience in the States. Capable of supervising and assuming full responsibilities. Desire supervisory job in Plastics field in the United States. American citizen. Reply Box 6456, Modern Plastics.

WANTED—PROGRESSIVE EMPLOYER with job worth $13,000-$15,000 in custom molding engineering or manufacturing—end user plastics product engineering or plastics liaison—or molding material sales engineering. Over 20 years in custom molded plastics; comprehensive engineering background—tooling, design, process, sales; purchasing and inventory control experience; three years as supervisor of manufacturing engineering section with 54 people including 20 engineers. Age 42,—married—family. B.S. in chemistry. Well balanced personality. Outside interests include Scouts, church, golf, fishing. Reply Box 6460, Modern Plastics.

CONTINUOUS FORMING AND EXTRUSION—Equipment Design and Development Engineer, 5 years total experience vending cups and lids. Chicago location desired. Reply Box 6454, Modern Plastics.

SITUATION WANTED: Sales Manager, under 50, now employed. Injection molded thin wall containers. Personally responsible $1,000,000 annual sales to national accounts. Engineer, experienced, product design, molds. Seeks greater incentive and/or opportunity. Available for interview, Chicago or New York City. Will relocate. Reply Box 6444, Modern Plastics.

CHEMIST: With thirty years experience in the formulation, manufacture, and application of phenolic and urea resins, adhesives and molding compounds available for consulting and product development work. Reply Box 6466, Modern Plastics.

TOP TALENT AVAILABLE: Product Development Engineer. Specialist in Fiberglass, air and vacuum formed sheet, molded paper laminates, new uses for new materials. 10 years of successful products. Available as consultant on design and production problems. If your problems are big enough make an offer for full time problem-solver. Highest references, both personal and performance. Reply Box 6464, Modern Plastics.

Miscellaneous

MANUFACTURER'S REPRESENTATIVE: Aggressive young organization, heavy technical experience, seeks additional lines in virgin & reprocessed molding powders, related colorants & additives for the Western New York, Northeastern Penna. & Southern Ontario area. Reply Box 6465, Modern Plastics.

CUSTOM COMPOUNDING Specializing in Vinyl Dry Blends, pellets, master batches and color dispersions. Write for samples and prices. MARSHALL SALES & EXPORT CORP., P.O. BOX 46, Bridgeport, Penna.

ITALIAN FACTORY Sells Whole Plant for Plastic Flowers—Fruits Production—Technical assistance eventually capital participation—discretion and references are requested. Write Avv. Menzio Via Misericordia 3, Torino, Italy.

WELL-KNOWN BRITISH FIRM forming part of large engineering group and producing substantial quantities of phenolic laminates, flexible insulation, plastics and rubber treated textiles, is seeking lines for expansion where specialised knowhow, patents or capital can restrict competition. The company has adequate technical and financial resources to manufacture and sell in Britain, Europe and the Commonwealth countries. A meeting with any patentee or manufacturer with lines capable of development in these territories would be welcome. Reply Box 6470, Modern Plastics.

PLANT WANTED: (Injection Molding) Proprietary line preferred. Must be located East of Mississippi. Principals only. BROWN AND SHIPLEY CORP. (Industrial Branch), P.O. Box #666, Hillside, N.J.

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MANUFACTURERS REPRESENTATIVE interested in a general line of finished Plastic products for the Builders Supply—Toy—Hardware trade—Western Pennsylvania. Reply Box 6471, Modern Plastics.

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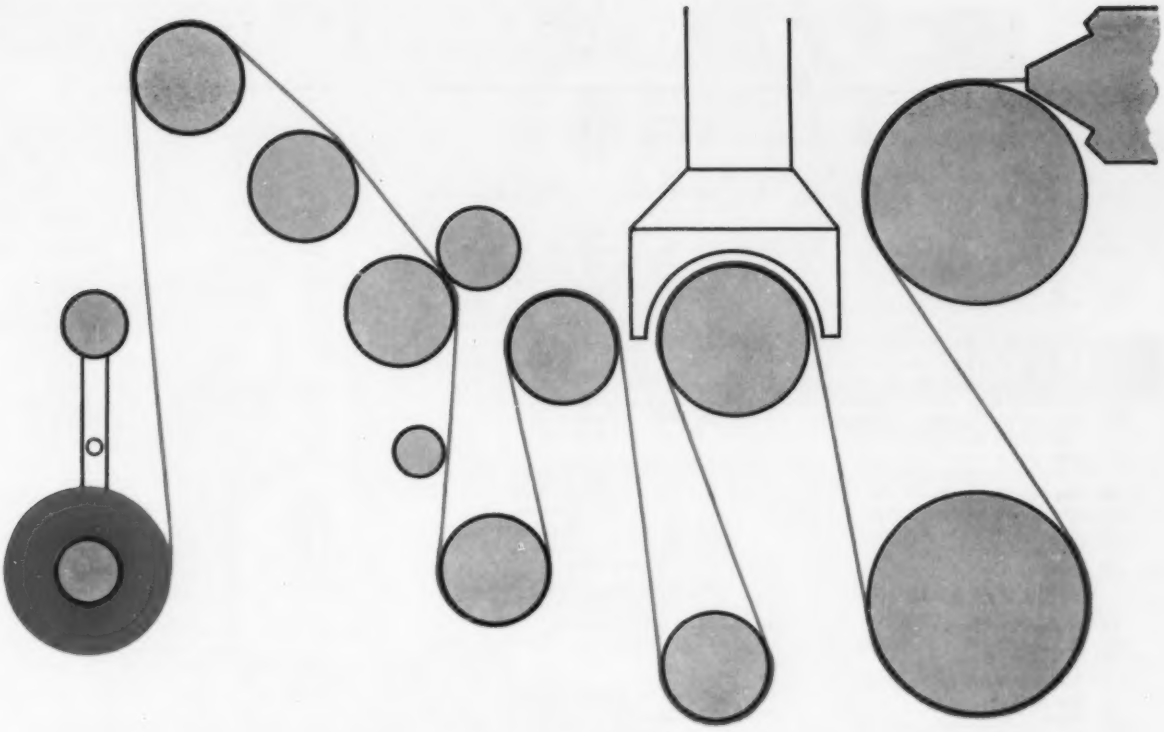

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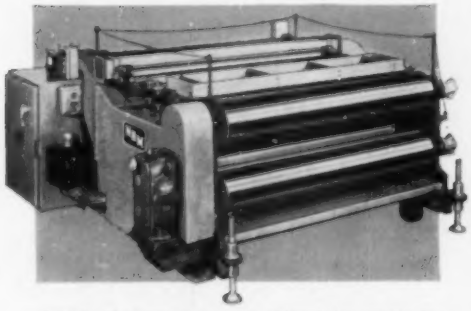

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2 OPERATION—
full automatic, semi-automatic or manual control.

3 PART EJECTION—
hydraulically operated top or bottom ejection—air operated hold up or hold down insures parts stay in desired mold half.

4 INSULATED MOLD MOUNTING PLATE—
to keep heat in mold, and keep press platens and system cool.

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6 LARGE PLATEN AREA—
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7 AUTOMATIC PREFORM PREHEATER-LOADER—
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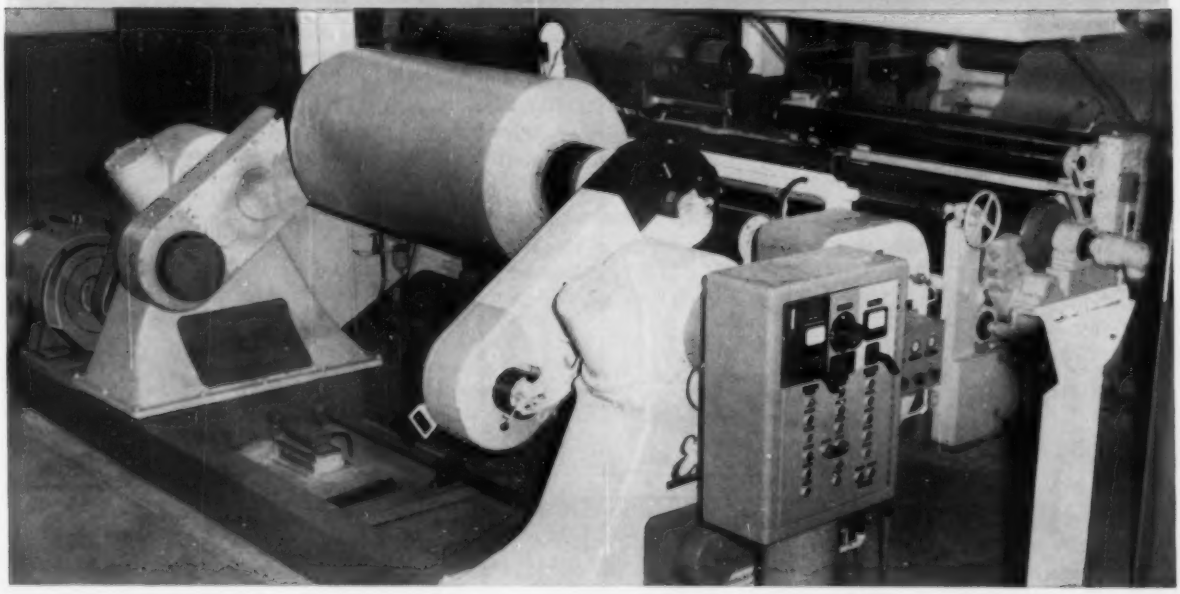


EDITORIAL

Welcome to "Plastec"—a needed service

Announcement that a Plastics Technical Evaluation Center, operating under the office of Defense Research and Engineering, has been established at Picatinny Arsenal, Dover, N. J., is being received with cheers by the plastics industries.

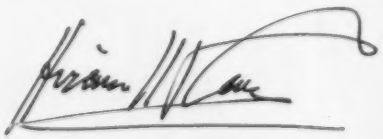
For years material makers and processors, serving the military or seeking military business, have been confused and confounded by the large number of parallel programs in Army, Navy, and Air Force, and even in different sub-services of each —often with little communication between them. "Plastec" is designed to centralize the technology, put the reports under one roof, and relate them to each other.

It has always been difficult for companies to obtain state-of-the-art reports from abroad relating to work similar to that being done in the United States. "Plastec" translations of these will now be filed.

Then there has always been the problem of "permanent literature." A paper given at a conference and reproduced in a preprint, unless later published in a regular periodical such as MODERN PLASTICS; and, therefore, available to researchers for years to come, could not be considered permanently published. Yet, there are not enough pages in all periodicals to permit publishing a tenth of the papers prepared. The "Plastec" facility at least puts in one place, available to researchers, all such material.

While primarily designed to serve the Department of Defense and its suppliers, information recorded will be made available to non-military interests through the Office of Technical Services, Department of Commerce, Washington 25, D. C. Abstract cards, microfilm reproductions, and other means will be used to supply such information at minimum cost.

Since "Know-How" is the name of a two-way street, we recommend that all companies now interested or likely in the future to want to use the "Plastec" service, make a policy of getting their own technical and engineering papers on file at Picatinny Arsenal.



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THIS YEAR looks like another record-breaker for boat sales. And particularly for glass-reinforced polyester models. As the production of polyester resins continues to grow, more and more resin manufacturers are relying on Pittsburgh Coke as a dependable source for high purity maleic anhydride, phthalic anhydride and fumaric acid—three key chemicals used in the production of polyester resins.

The "best buy" qualities of polyester plastic boats—from outboard runabouts to cabin cruisers—are apparent to novice and old-time boaters alike. They're not only lighter and more durable than conventional boats, but they require far less upkeep and no painting. The boat industry promises to continue growing as a major market for polyester resin manufacturers.

If you make polyester resins, you'll save time and money buying "all three" intermediates from Pittsburgh. Paper work and shipping costs can be reduced . . . and you'll be dealing with one efficient, coordinated sales and technical service team anxious to meet your delivery requirements and help reduce your processing costs. Call Pittsburgh for *your* next shipment of intermediates!

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For further information on the full line of G-E phenolic molding compounds – outlined in a new, 12-page illustrated brochure – write for Catalog CDC-370. General Electric Company, Section MP-30, Chemical Materials Dept., Pittsfield, Mass.